3. AFFECTED ENVIRONMENT

Elements of the Affected Environment are also described in the Quadrant II CAS/CMS [Chapter 1.3].

3.1 LAND AND FACILITY USE

PORTS is situated on a 1503-ha (3714-acre) parcel of DOE-owned land (Fig. 1.2). The Perimeter Road surrounds a 485.6-ha (1200-acre) centrally developed area. The terrain surrounding the plant, except for the Scioto River floodplain, consists of marginal farmland and densely forested hills. The Scioto River floodplain is farmed extensively, particularly with grain crops.

The reservation land outside the Perimeter Road is used for a variety of purposes, including a water treatment plant, holding ponds, sanitary and inert landfill, and open and forested buffer areas. The majority of the site improvements associated with the GDP are located within the 202-ha (500-acre) fenced area. Within this area are three large process buildings and auxiliary facilities that are currently leased to USEC. A second, large developed area covering about 121 ha (300 acres) contains the facilities built for GCEP. These areas are largely devoid of trees, with grass and paved roadways dominating the open space. The remaining area within the Perimeter Road has been cleared and is essentially level. Controlled access exists within the limited security area as well as closed sites.

Approximately 190 buildings as well as the utility structures are located within the PORTS site. In general, the X-100 through X-700 series of buildings are directly related to the gaseous diffusion process. Most of the buildings in this series are located within the 202-ha (500-acre) fenced area. The X-200 and X-300 series are the production buildings and related infrastructure facilities. Most of the buildings and infrastructure included in the X-1000 through X-7000 series of buildings are located within the 121-ha (300-acre) GCEP expansion area. The facilities containing the administrative activities include the facilities numbered in the X-100 series for the GDP and X-1000 series for the more recent construction. The facilities house such activities as administrative offices, engineering, cafeteria, medical services, security, and fire protection.

The X-500 series in the GDP and the X-5000 series in the GCEP area pertain to the power operations facilities. Included are switchyards, switch houses, valve houses, and test and repair facilities. The X-600 and X-6000 series of facilities are utility related functions. Included are a steam plant, well fields, pump houses, a water treatment plant, a sewage treatment plant (STP), and numerous cooling towers. In addition, dry air and nitrogen generation facilities are housed in the GDP process buildings. The X-700 and X-7000 series of buildings house chemical operations, a laboratory, maintenance shops, and numerous storage facilities. The major maintenance facility for the GDP is the X-720 building. The building contains more than 91,440 m^2 (300,000 ft^2) of space for various shop activities, offices, and storage of parts. The GCEP-equivalent facility is the X-7721 Maintenance, Stores, and Training Building located in the 121-ha (300-acre) expansion area. The X-7721 building contains more than 36,576 m^2 (120,000 ft^2) of space.

The uranium enrichment production and operations facilities at PORTS are leased by USEC. The lease between DOE and USEC is active through July 1, 2010, although some facilities may be returned to DOE on an earlier date. Besides the leased facilities, USEC also leases common areas that include ditches, creeks, ponds, and other areas (i.e., roads and rail spurs) necessary for ingress, egress, and proper maintenance of facilities.

3.2 CLIMATE AND AIR QUALITY

3.2.1 Climate

PORTS is located in the humid continental climate zone of North America and has weather conditions that vary greatly throughout the year. The mean annual temperature is about 12.7^oC (55^oF). Average summer and winter temperatures are 22.2^oC (72^oF) and 0^oC (32^oF), respectively. Record high and low temperatures are 39.4^oC (103^oF) and –32^oC (–25^oF), respectively.

Prevailing winds are out of the south–southwest and average 8.05 kilometers per hour (km/h) [5 miles per hour (mph)]. The highest monthly average wind speed, 17.7 km/h (11 mph), typically occurs in the spring. Total precipitation averages approximately 101.6 cm (40 in.) annually and is usually well distributed throughout the year. Fall is the driest season. Snowfall averages approximately 51.8 cm/year (20.4 in./year). Although snow amounts and frequencies vary greatly from year to year, an average 8 d/year have greater than 2.54 cm (1 in.) of snowfall.

3.2.2 Air Quality

The PORTS region is classified as an attainment area for the pollutants listed in the National Ambient Air Quality Standards (NAAQS). These standards are shown in Table 3.1. Primary standards protect against adverse health effects, while secondary standards protect against welfare effects such as damage to crops, vegetation, and buildings. The State of Ohio has adopted the NAAQS and regulations to guide the evaluation of hazardous air pollutants and toxins to specify permissible short- and long-term concentrations.

PORTS is located in a Class II prevention of significant deterioration (PSD) area. PSD regulations were established to prevent significant deterioration of air quality in areas that already meet the NAAQS. Specific details of PSD are found in 40 *CFR* 51.166. Among other provisions, cumulative increases in sulfur dioxide, nitrogen dioxide, and particulate matter less than 10 microns in diameter (PM-10 levels) after specified baseline dates must not exceed specified maximum allowable amounts. These allowable increases, also known as increments, are especially stringent in areas designated as Class I areas (e.g., national parks and wilderness areas) where the preservation of clean air is particularly important. All areas not designated as Class I currently are designated as Class II. The nearest Class I PSD area is the Dolly Sods Wilderness Area, which is approximately 280 km (174 miles) east of PORTS in West Virginia. Since PORTS is located in an area that is currently in compliance with the NAAQS and considered an attainment area, a conformity analysis as described in 40 *CFR* 51.853 is not applicable.

Airborne discharges of radionuclides from PORTS are regulated under the CAA National Emission Standards for Hazardous Air Pollutants (NESHAP). Releases of radionuclides are used to calculate a dose to members of the public (Sect. 3.11.1).

The majority of radiological emissions at PORTS resulted from the uranium enrichment process operated by DOE until 1993 and subsequently by USEC. In 2000, USEC reported emissions of 0.09 Ci (curie: a measure of radioactivity) from its 19 radionuclide sources. DOE-PORTS is responsible for four radiological emission sources, the X-326 L-Cage glove box, the X-744G glove box, and the X-623 and X-624 Groundwater Treatment Facilities. The glove boxes are used to repackage wastes or other materials that contain radionuclides. The two groundwater treatment facilities emit small quantities of radionuclides to the air in the process of removing chemical contaminants from the groundwater. Emissions from these sources are based on waste analysis data and standard engineering procedures. Radiological emissions from these two DOE sources were 0.000063 Ci in 2000 (DOE 2001c).

Nonradiological releases to the atmosphere are permitted under the Ohio Permit to Operate regulations. Under Ohio regulations, the Ohio EPA can register small emission sources rather than issue a formal permit. DOE-PORTS had 4 permitted and 10 registered air emission sources at the end of 2000.

Table 3.1 Air quality standards

Pollutant	Averaging Time	NAAQS (mg/m^3)		Allowable PSD increment (mg/m^3)[a]	
		Primary	Secondary	Class I	Class II
Sulfur dioxide	3 h[b]		1300	25	512
	24 h[b]	365		5	91
	Annual	80		2	20
Nitrogen dioxide	Annual	100	100	2.5	25
Ozone	1 h[c]	235	235		
	8 h[d]	157	157		
Carbon monoxide	1 h[b]	10,000			
	8 h[b]	40,000			
PM-10[e]	24 h[c]	150	150	8	30
	Annual	50	50	4	17
PM-2.5[f,d]	24 h	65	65		
	Annual	15	15		
Lead	3 months[g]	1.5	1.5		

Note: Where no value is listed, there is no corresponding standard.

[a]Class I areas are specifically designated areas in which degradation of air quality is severely restricted; Class II areas have a less stringent set of allowable increments.

[b]Not to be exceeded more than once per year.

[c]Not to be exceeded more than one day per year on average over 3 years.

[d]The ozone 8-h standard and the PM-2.5 standards are included for information only. A 1999 federal court ruling blocked implementation of these standards, which the U.S. EPA proposed in 1997.

[e]Particulate matter less than 10 μm in diameter.

[f]Particulate matter less than 2.5 μm in diameter.

[g]Calendar quarter.

NAAQS = National Ambient Air Quality Standard.

PSD = prevention of significant deterioration.

DOE-PORTS operates numerous small sources of conventional air pollutants such as nitrogen oxides, sulfur dioxide, and particulate matter. These emissions are estimated every 2 years for the Ohio EPA's biennial emission fee statement. Emissions of nonradiological air pollutants at PORTS are estimated using various U.S. EPA-approved procedures. In calculating air emissions, DOE assumes that each source emits the maximum allowable amount of each pollutant as provided in the permit or registration for the source. Under this worst-case scenario, DOE-PORTS estimated emissions of sulfur dioxide, nitrogen oxides, organic compounds, and particulate matter in 1999 to be 13 tons/year. Most of these worst-case emissions resulted from particulate (dust) emissions from the X-734 landfill closure. Worst-case air emissions excluding this source are no more than 1.5 tons/year (DOE 2000c). Emissions for 2000 are not calculated until 2002, but are expected to be similar to 1999 (DOE 2001c).

The largest non-radiological airborne discharges from USEC sources are from the coal-fired boilers at the X-600 steam plant. The boilers are permitted by Ohio EPA with opacity, particulate, and sulfur dioxide limits. Electrostatic precipitators on each of the boilers control opacity and particulate emissions. In addition, the boilers emit nitrogen oxides and carbon monoxide. There are also minor contributions of these pollutants from oil-fired heaters, stationary diesel motors, and mobile sources (e.g., cars and trucks).

Other air pollutants emitted from USEC operations include gaseous fluorides, water treatment chemicals, cleaning solvent vapors, and process coolants.

In October 2000, DOE collected data from a monitoring network of 15 air samplers. Data were collected both on-site at PORTS and in the area surrounding PORTS. The monitoring network is intended to assess whether air emission from PORTS affect air quality in the surrounding area. The air sampling stations collect samples which are analyzed for americium-241, neptunium-237, plutonium-238, plutonium-239/240, plutonium-242, thorium-228, thorium-230, thorium-232, uranium-233/234, uranium-235, uranium-236, uranium-238, percent uranium-235, and total uranium. A background ambient air monitoring station is located approximately 21 km (13 miles) southwest of the site. The analytical results from air sampling stations closer to the plant are compared to these background measurements.

The latest air monitoring results for the site are published in the U.S. Department of Energy, Portsmouth Annual Environmental Report for 2000 (DOE 2001c).

3.3 GEOLOGY AND SOILS

3.3.1 Site Geology

The near-surface geologic materials that influence the hydrologic system at PORTS consist of several bedrock formations and unconsolidated deposits. The bedrock formations include (from oldest to youngest) Bedford Shale, Berea Sandstone, Sunbury Shale, and Cuyahoga Shale. The unconsolidated deposits of clay, silt, sand, and gravel compose the Minford Clay and Silt (Minford) member and the Gallia Sand and Gravel (Gallia) member of the Teays formation (DOE 1996a). Prior to the Pleistocene glaciation, the Teays River and its tributaries were the dominant drainage system in Ohio.

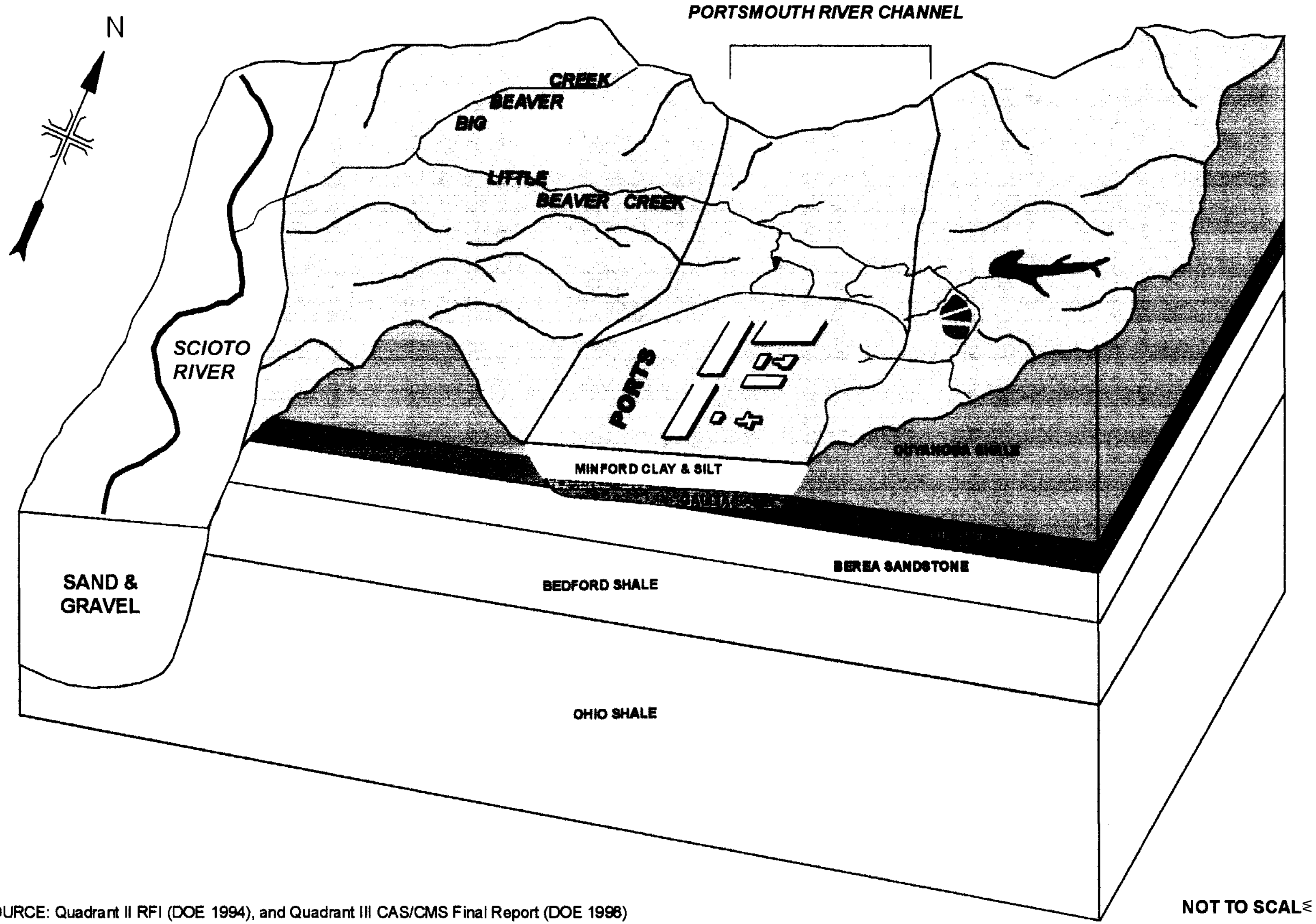
The pre-glacial Portsmouth River, a tributary of the Teays, flowed north across the plant site, cutting down through the Cuyahoga Shale and into the Sunbury Shale and Berea Sandstone, and deposited fluvial silt, sand, and gravel of the Gallia member of the Teays Formation (Fig. 3.1).

3.3.2 Bedrock Geology

Bedrock consisting of clastic sedimentary rocks underlies the unconsolidated sediments beneath PORTS. The geologic structure of the area is very simple, with the bedrock (Cuyahoga Shale, Sunbury Shale, Berea Sandstone, and Bedford Shale) dipping gently to the east–southeast. No known geologic faults are located in the area; however, joints and fractures are present in the bedrock formations.

The Bedford Shale is the lowest stratigraphic unit encountered during environmental investigative activities at the site. Bedford Shale is composed of thinly bedded shale with interbeds and laminations of grey, fine-grained sandstone and siltstone. The typical depth to the top of this formation at PORTS is 21.3 to 30.5 m (70 to 100 ft) below ground surface (bgs). However, Bedford Shale outcrops are present in deeply incised streams and valleys within the reservation. The Bedford Shale averages 30.5 m (100 ft) in thickness.

The Berea Sandstone is a light grey, thickly bedded, fine-grained sandstone with thin shale laminations. The top 3.05 to 4.57 m (10 to 15 ft) consists of a massive sandstone bed with few joints or shale laminae. The Berea Sandstone averages 10.67 m (35 ft) in thickness; however, the lower 3.05 m (10 ft) has numerous shale laminations and is very similar to the underlying Bedford Shale. This gradational contact does not allow for a precise determination of the thickness of the Berea Sandstone.



SOURCE: Quadrant II RFI (DOE 1994), and Quadrant III CAS/CMS Final Report (DOE 1998)

Pro2Serve Technical Solutions | **Fig. 3.1** Schematic block diagram showing geology at PORTS.

DOCUMENT ID: DOE/EA-1459 | DRAWING ID: Fig3-1a Q2EA.cdr | DRAWING DATE: May 18, 2001

Regionally, Berea Sandstone contains naturally occurring hydrocarbons (oil and gas) in quantities sufficient for commercial production. Generally, within Perimeter Road, the Berea Sandstone is the uppermost bedrock unit beneath the western portion of PORTS but is overlain by the Sunbury Shale to the east.

The Sunbury Shale is a black, very carbonaceous shale. The Sunbury Shale is 6.09 m (20 ft) thick beneath much of PORTS, but thins westward as a result of erosion by the ancient Portsmouth River, and is absent on the western half of the site. The Sunbury Shale also is absent in the drainage of Little Beaver Creek downstream of the X-611A Lime Sludge Lagoons and the southern portion of Big Run Creek, where it has been removed by erosion. The Sunbury Shale underlies the unconsolidated Gallia beneath the most industrialized eastern portion of the plant and underlies the Cuyahoga Shale outside of the Portsmouth River Valley.

The Cuyahoga Shale, the youngest and uppermost bedrock unit at the site, forms the hills surrounding PORTS. The Cuyahoga Shale has been eroded from most of the active portion of PORTS. It consists of grey, thinly bedded shale with scattered lenses of fine-grained sandstone and regionally reaches a thickness of approximately 48.77 m (160 ft).

3.3.3 Unconsolidated Deposits

Unconsolidated deposits in the vicinity of PORTS fill the ancient Portsmouth River Valley to depths of approximately 9.1 to 12.2 m (30 to 40 ft). The unconsolidated deposits are divided into two members of the Teays Formation, the Minford Clay and Silt and the Gallia Sand and Gravel.

Minford Clay and Silt. The Minford is the uppermost stratigraphic unit beneath PORTS. The Minford averages 6.1 to 9.1 m (20 to 30 ft) in thickness and grades from predominantly silt and very fine sand at its base to clay near the surface. The upper clay unit averages 4.88 m (16 ft) in thickness, is reddish-brown, plastic, and silty, and contains traces of sand and fine gravel in some locations. These thicknesses vary greatly as a result of construction cutting and filling operations, as discussed in the next paragraph. The lower silt unit averages 2.13 m (7 ft) in thickness, is yellow-brown and semi-plastic, and contains varying amounts of clay and very fine sand.

During the initial grading of the site, the deposits within the Perimeter Road were reworked to a depth as great as 6.1 m (20 ft) by pre-construction cut and fill activity. In most cases, the fill is indistinguishable from the undisturbed Minford. The combination of construction activities, bedrock topography, and erosion by modern streams has influenced the areal extent and thickness of the Minford at PORTS.

Gallia Sand and Gravel. Prior to Pleistocene glaciation, the Portsmouth River meandered north through the valley currently occupied by PORTS and deposited the sand and gravel of the Gallia. The Gallia averages 0.9 to 1.22 m (3 to 4 ft) in thickness at the site and is characterized by poorly sorted sand and gravel with silt and clay. Channel migration and variation in depositional environments that occurred during deposition of the Gallia resulted in the variable thickness of the Gallia. The areas of thickest accumulation of Gallia may represent the former channel location and include areas under the southern end of the X-330 Process Building and near the X-701B Holding Pond. Gallia deposits beneath PORTS are generally absent above an approximate elevation of 198 m (650 ft) above mean sea level (AMSL).

As a result of similar depositional environments and source material, deposits from modern streams at the site often are visually indistinguishable from Gallia deposits. The modern surface-water drainage also has eroded the unconsolidated sediments and resulted in locally thin or absent Gallia and Minford deposits.

3.3.4 Surface Soil Description

According to the Soil Survey of Pike County, Ohio, 22 soil types occur within the PORTS property boundary with the predominant soil type being Omulga Silt Loam (U.S. Department of Agriculture 1990). Most of the area within the active portion of PORTS is classified as Urban land-Omulga complex with a 0 to 6% slope, which consists of Urban land and a deep, nearly level, gently sloping, moderately well-drained Omulga soil in preglacial valleys. The Urban land is covered by roads, parking lots, buildings, and railroads that are so obscure or alter the soil that identification of the soil series is not feasible.

The surface layer of Omulga Silt Loam is dark grayish-brown, friable (easily crumbled), and approximately 25.4 cm (10 in.) thick. The subsoil is approximately 137.2 cm (54 in.) thick and is composed of three portions: (1) a yellowish-brown, friable silt loam; (2) a fragipan (brittle, compacted subsurface soil) of yellowish-brown, mottled, firm, and brittle silty clay loam middle; and (3) a yellowish-brown, mottled, friable silt loam approximately 50.8 cm (20 in.) thick. The root zone generally is restricted to the zone above the fragipan and contains none of the Urban land soils. Well-developed soil horizons may not be present in all areas inside Perimeter Road because of cut-and-fill operations related to construction.

Prime farmland is land that has the best combination of physical and chemical characteristics for producing crops of statewide or local importance. Seven of the soils that occur within the PORTS property are listed in the Pike County Soil Survey as prime farmland soils. Prime farmland is protected by the Farmland Protection Policy Act which seeks "…to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmlands to nonagricultural uses…" [7 USC 4201(b)]. No formal prime farmland soil survey has been conducted at PORTS.

Although containing some of the soil types considered prime farmland types, the areas affected by the proposed action have not been farmed since the early 1950's when the Gaseous Diffusion Plant and support facilities were constructed. Since that time these areas have been incorporated into the industrial site and are no longer considered suitable for conversion to farmland.

3.3.5 Seismicity

Geological studies conducted to determine the potential seismic hazard for PORTS have determined that only one fault is located within 40 km (25 miles) of the site, and no seismicity has been recorded on it and no recorded seismic events have occurred within 40 km (25 miles) of the site. The Kentucky River fault zone and the Bryant Station-Hickman Creek fault are located farther away from PORTS, the latter fault being roughly 96.5 km (60 miles) to the southwest. These faults bound the southern part of a north-to-northeast-trending area of seismicity in central and eastern Ohio. Soil testing for the GCEP facility indicated that the potential for earthquake-induced soil liquefaction is relatively low. The potential for soil-structure interaction (ground motion magnification) is also slight. Also, Pike County is not one of the political jurisdictions listed in Appendix VI of 40 *CFR* 264 for which compliance with seismic standards must be demonstrated (MMES 1994).

3.4 WATER RESOURCES

3.4.1 Groundwater

3.4.1.1 Site hydrogeology

The groundwater flow system at PORTS includes two water-bearing units (the bedrock Berea Sandstone and the unconsolidated Gallia) and two aquitards (the Sunbury Shale and the unconsolidated

Minford). The basal portion of the Minford is generally grouped with the Gallia to form the uppermost and primary aquifer at the facility. The hydraulic properties of these units and groundwater flow at the site also have been well defined during the RFI.

Groundwater recharge and discharge areas at PORTS include both natural and man-made recharge and discharge areas. Natural recharge to the groundwater flow system at PORTS comes from precipitation.

Land use and the presence of thick upper Minford Clay and the Sunbury Shale effectively reduce recharge to underlying units. Recharge to the Minford and Gallia is reduced because a large percentage of the land is paved or covered by buildings. However, recharge to the Berea Sandstone from the overlying Gallia is increased as a result of the absence of the Sunbury Shale.

Groundwater flow at PORTS can generally be divided into four separate flow regions. Groundwater divides provide the basis for separation of the reservation into quadrants. The groundwater divides generally coincide with topographic highs along the center of the industrial complex (from south to north) and topographic highs radiating outward and separating the predominant surface water features draining the facility. The locations of the groundwater flow divides may migrate small distances in response to seasonal changes in precipitation and groundwater recharge. The rates of pumping the X-700/X-705 sumps and remediation wells can also influence the location of the groundwater divides in some areas.

Groundwater at PORTS discharges primarily to surface streams. Groundwater in the eastern and northern portions of the facility discharges to the East and North Drainage Ditches and to the Little Beaver Creek. In the southern portion of the facility, groundwater discharges to the Big Run Creek and to the unnamed southwest drainage ditch. Along the western boundary of the site, the West Drainage Ditch serves as a local discharge area for all geologic units.

Groundwater recharge and discharge areas at PORTS also are affected by man-made features including the storm sewer system, the sanitary sewer system, the recirculating cooling water (RCW) system, water lines, and building sumps. The storm sewer system consists of numerous large-diameter culverts and pipes that drain surface water from discrete segments of the site. Groundwater collected by these drains is transported to the discharge point for each storm drain. Discharge points for the storm drains generally coincide with site National Pollutant Discharge Elimination System (NPDES) outfalls that eventually discharge to the surface water units described previously. The RCW and fire hydrant supply systems are pressurized to ensure proper transport of water. If these systems have leaks, they may locally act as sources of recharge to groundwater. Although recharge from these lines to groundwater is difficult to measure, overall groundwater directions are not affected. These systems are generally located within 1.8 to 3.7 m (6 to 12 ft) of the ground surface. The depth to groundwater generally is more than 3.7 m (12 ft) below the ground surface. Consequently, these systems and their associated backfills are usually located above the local water table. On the basis of these factors, none of these systems appears to act as a major discharge conduit for groundwater. Man-made features that do have a major effect on groundwater flow at the site include a set of sumps located in the X-700 Cleaning and the X-705 Decontamination Buildings, extraction wells in the vicinity of X-231B Oil Biodegradation Plot, X-701B Holding Pond, and groundwater interceptor trenches at X-749 Contaminated Material Storage Yard and X-701B Holding Pond area.

Groundwater is used as a domestic, municipal, and industrial water supply in the vicinity of PORTS. Most municipal and industrial water supplies in Pike County are developed from the Scioto River Valley buried aquifer. Groundwater in the Berea sandstone and Gallia sand formations that underlie PORTS is not used as domestic, municipal, or industrial water supplies. Domestic water supplies are obtained from either unconsolidated deposits in pre-glacial valleys, major tributaries to the Scioto River Valley, or from fractured bedrock encountered during drilling.

The PORTS reservation is the largest industrial user of water in the vicinity and obtains its water from the X-608, X-605G, and X-6609 water supply well fields, which are next to the Scioto River south of Piketon. The wells tap the Scioto River Valley buried aquifer. Total groundwater production averages 49.4 million liters per day (L/d) [13 million gals per day (MGD)] for the entire site, including USEC activities (DOE 1999b).

3.4.1.2 Groundwater monitoring

Groundwater and surface water monitoring at PORTS was initiated in the mid 1980s. Groundwater monitoring has been conducted in response to regulatory requirements of the Ohio Administrative Code, RCRA closure documents, an ACO between DOE and the U.S. EPA, a Consent Decree between the DOE and the State of Ohio, and DOE Orders.

Because of the numerous regulatory programs, the *Integrated Groundwater Monitoring Plan* (IGWMP) was developed to minimize the potential for confusion in interpreting requirements and to maximize resources for collecting the data needed for sound decision making and was designed to establish all groundwater monitoring requirements for PORTS. The IGWMP was reviewed and approved by Ohio EPA and implemented at PORTS starting on April 1, 1999. The IGWMP is revised as monitoring needs change. The latest approved version of the IGWMP was issued in October 2001.

The process of developing an integrated groundwater monitoring program at PORTS began by selecting or designating relatively large-scale contamination areas called groundwater Areas of Concern. Areas of Concern at PORTS are generally large areas containing multiple source/release sites contributing to physically contiguous or co-mingled contaminant plumes or remediation concerns that are the subject of corrective actions or RCRA closures.

In addition to the detection and assessment monitoring at PORTS, the integrated approach to groundwater monitoring includes perimeter exit pathway monitoring, sampling selected surface water locations and sampling PORTS water supply and surrounding residents' drinking water. Additional information and monitoring results are provided in the 2000 Groundwater Monitoring Report (DOE 2001d).

In general, samples are collected from wells at each area listed above and are analyzed for metals, volatile organic compounds (VOCs), and radiological constituents. Data for the X-749A Classified Materials Disposal Facility (part of the Quadrant I Groundwater Investigative Area) and the X-735 Landfills are also statistically evaluated to determine whether the areas have impacted groundwater.

Groundwater plumes that consist of VOCs, primarily TCE, are found at the X-749/X-120/Peter Kiewit Landfill, Quadrant I Groundwater Investigative Area, Quadrant II Groundwater Investigative Area, X-701B Holding Pond Area, and X-740 Hazardous Waste Storage Facility Area.

Selected monitoring wells, monitoring frequency, and analytical parameters are included in the IGWMP for each of the groundwater Areas of Concern listed below:

<u>Quadrant I</u>

X-749 Contaminated Materials Disposal Facility/X-120 Old Training Facility/Peter Kiewit Landfill, Quadrant I Groundwater Investigative Area/X-749A Classified Materials Disposal Facility, Quadrant II

Quadrant II Groundwater Investigative Area,
X-701B Holding Pond Area,

Quadrant III

X-616 Chromium Sludge Surface Impoundments,
X-740 Hazardous Waste Storage Facility Area,

Quadrant IV

X-611A Former Lime Sludge Lagoons,
X-735 Landfills, and
X-734 Landfills.

Monitoring wells were selected to serve one or more of the following broad technical objectives: source/release monitoring, plume monitoring, and remedial-action-effectiveness monitoring. Source monitoring is designed to monitor as close as feasible to potential sources of groundwater contamination such as landfills and holding ponds. Plume monitoring is designed to assess the concentrations and extent of known contaminant plumes. Remedial-action-effectiveness monitoring is designed to evaluate the performance of interim remedial measures, corrective actions, or technology demonstrations. These broad technical purposes approximate the regulatory definitions of detection monitoring and assessment monitoring.

3.4.1.3 Groundwater treatment

In 2000, a combined total of approximately 20.7 million gal of contaminated groundwater was treated at the X-622, X-622T, X-623, X-624, and X-625 Groundwater Treatment Facilities. Approximately 129 gals of TCE were removed from the groundwater. All processed water is discharged through NPDES outfalls before exiting PORTS.

- X-622—TCE-contaminated groundwater from the 5-Unit Groundwater Investigative Area, the X-749 Landfill, and the Peter Kiewit groundwater collection system is processed at the X-622 treatment unit using activated carbon and green sand filtration.

- X-622T—At this treatment facility, activated carbon is used to treat contaminated groundwater from the X-700 Chemical Cleaning facility and the X-705 Decontamination Building. The contaminated groundwater is extracted from sumps located in the basement of each building.

- X-623—This groundwater treatment facility consists of an air stripper with off-gas activated carbon filtration and aqueous-phase activated carbon filtration. X-623 provides treatment for contaminated groundwater from the X-701B holding pond and three groundwater extraction wells in the X-701B plume area.

- X-624—TCE-contaminated groundwater from the X-237 interceptor trench associated with the X-701B plume is treated via an air stripper with off-gas activated carbon filtration, plus carbon filtration of the effluent water.

- X-625—Groundwater that is gravity fed to this facility (from a horizontal well associated with the X-749/X-120 groundwater plume and as part of an ongoing technology demonstration) is treated with various passive media such as iron fillings.

3.4.2 Surface Water

3.4.2.1 Site hydrology

PORTS is drained by several small tributaries of the Scioto River, which flows south to the Ohio River. Sources of surface water drainage include storm water runoff, groundwater discharge, and effluent from plant processes.

The largest stream on the site is Little Beaver Creek, which drains the northern and northwestern portions of the site before discharging into Big Beaver Creek. Little Beaver Creek is a small, high-gradient, unmodified stream that receives the majority of its flow from the X-230J7 East Holding Pond discharge through the East Drainage Ditch. Little Beaver Creek also receives effluent via the Northeast Drainage Ditch through the outfall from the X-230J6 Northeast Holding Pond and the North Drainage Ditch through the X-230L North Holding Pond Outfall. Substrates are predominantly slab boulders and bedrock at the upper reach to gravel and sand near the mouth. During parts of the year, intermittent flow conditions exist upstream from the X-230J7 discharge. During these times the upstream section is composed of isolated pools with no observable flow (Ohio EPA 1998).

Big Run Creek, located in the southeastern portion of the site, receives outfall effluent from the X-230K South Holding Pond at the headwaters of the stream. Big Run Creek continues southwest from the DOE property boundary until it discharges into the Scioto River, approximately 6.4 km (4 miles) from the site. The substrates are predominated by gravel and cobble, and the channel has remained unmodified. Because of the small stream size and high gradient, deep pools are absent. Big Run Creek often has intermittent flow during parts of the year (Ohio EPA 1993).

Two ditches drain the western and southwestern portions of the site; flow is low to intermittent. The West Drainage Ditch receives water from surface water runoff, storm sewers, and plant effluent. The unnamed southwest drainage ditch receives water mainly from storm sewers and groundwater discharge. These two drainage ditches continue west and ultimately discharge into the Scioto River.

3.4.2.2 Surface water monitoring

The quality of surface waters at PORTS is affected by wastewater discharges and groundwater transport of contaminants from land disposal of waste. Although bedrock characteristics differ somewhat among the watersheds of these surface waters, the observed differences in water chemistry are attributed to different contaminant loadings rather than to geologic variation (DOE 1999a). Water quality, radioactivity, and flow measurements are made at a number of stations operated by DOE. The frequency of surface water sampling (weekly, monthly, etc.) is specific to the analytes. Routine and permitted outfall samples are tested for radiological components (gross alpha, gross beta-gamma, technetium, and uranium), pH, flow, turbidity, TCE, oil and grease, heavy metals, fluorides, and phosphates.

Most surface water sampling at PORTS for nonradiological discharges is regulated by an NPDES permit enforced by the Ohio EPA. NPDES permit limitations regulate all plant process effluent discharged to the environment. The DOE-PORTS NPDES permit was issued in 1995 and modified in 1996 and 1997. The DOE-PORTS NPDES permit expired on March 31, 1999. DOE submitted a permit renewal application to Ohio EPA in 1998 in accordance with Ohio EPA requirements. The old permit will remain in effect until Ohio EPA issues a new permit. The Ohio EPA and U.S. EPA also conducted the annual inspection of all DOE-PORTS outfalls in June 2000. No problems were noted during the inspection.

DOE has six discharge points, or outfalls, through which water is discharged from the site. Three outfalls discharge directly to surface water (unnamed streams that flow to the Scioto River and Little Beaver Creek), and three discharge to the USEC X-6619 Sewage Treatment Plant before leaving the site through USEC Outfall 003 to the Scioto River. USEC is responsible for 11 NPDES outfalls at PORTS. Eight outfalls discharge directly to surface water (unnamed tributary to Scioto River, Little Beaver Creek, Big Run Creek, and the Scioto River). Two discharge to the X-6619 STP and Outfall 003 and one discharges to the X-230K South Holding Pond (Outfall 002).

DOE-PORTS Outfalls:

012 (X-2230M Holding Pond)
013 (X-2230N Holding Pond)
015 (X-624 Groundwater Treatment Facility)
608 (X-622 Groundwater Treatment Facility)
610 (X-623 Groundwater Treatment Facility)
611 (X-622T Groundwater Treatment Facility)

USEC Outfalls:

001 (X-230J7 East Holding Pond)
002 (X-230K South Holding Pond)
003 (X-6619 Sewage Treatment Plant)
004 [X-616 Chromate Treatment Facility (inactive)]
005 (X-611B Lime Sludge Lagoon)
009 (X-230L North Holding Pond)
010 (X-230J5 Northwest Holding Pond)
011 (X-230J6 Northeast Holding Pond)
602 (X-621 Coal Pile Runoff Treatment Facility)
604 (X-700 Biodenitrification Facility)
605 (X-705 Decontamination Microfiltration System)

Surface water monitoring of the Big Run Creek, East Drainage Ditch, Little Beaver Creek, North Holding Pond, unnamed southwestern drainage ditch, and West Drainage Ditch is conducted quarterly to assess the effect of the discharge of groundwater to streams (as base flow) at PORTS. This monitoring helps to support assessment monitoring at X-231B and X-701B and post-closure monitoring at X-616, X-735, and X-749. These surface monitoring locations are part of the Groundwater Monitoring Program and are not considered part of the PORTS NPDES sampling program (DOE 1999a).

3.4.2.3 Surface water quality

Both DOE and USEC monitor NPDES outfalls for radiological discharges by collecting water samples and analyzing the samples for radionuclides. Samples are analyzed for total uranium, isotopic uranium, gross alpha radiation, gross beta radiation, Technetium-99, Plutonium-239/240, Plutonium-238, Neptunium-237, and Americium-241. In 2000, total radioactivity discharged from DOE NPDES outfalls has been estimated at 4.1 mCi, and uranium discharges were estimated at 1.1 kg. Data collected by USEC and provided to DOE showed that USEC released 16.8 kg of uranium through 8 NPDES outfalls during 2000. Total radioactivity released was 31.4 mCi U and 62.5 mCi Technetium-99.

The Ohio EPA also requires monthly collection of surface water samples from the X-745C and X-745E depleted UF_6 cylinder yards. Samples are analyzed for alpha activity, beta activity, and total uranium. During 2000, alpha activity ranged from less than 0 picocurie per liter (pCi/L) to 15 pCi/L, beta activity ranged from less than 2 pCi/L to 44.7 pCi/L, total uranium ranged from less than 0 μg/L to

12 μg/L, and maximum values for specific radionuclides detected were: 16 pCi/L Technetium-99, 6 pCi/L Uranium-233/234, 0.19 pCi/L Uranium-235, 0.13 pCi/L Uranium-236, and 2.7 pCi/L Uranium-238. Samples also were analyzed for total PCBs, Americium-241, Americium-243, Neptunium-237, Plutonium-238, and Plutonium-239/240. These parameters were not detected at levels greater than the applicable detection limits.

Sampling of nonradioactive constituents is regulated under the NPDES permit. Analyses are performed in accordance with applicable regulations. This EA does not include results for nonradiological monitoring of USEC NPDES outfalls.

Results of a 1998 surface water monitoring study conducted in conjunction with groundwater assessment monitoring are as follows. No VOCs were detected at the sampling locations in Big Run Creek, Little Beaver Creek, East Drainage Ditch, North Holding Pond, or West Drainage Ditch, with the exception of small amounts of chloroform and other trihalomethanes that are common residuals in treated chlorinated drinking water. These streams received such treated water. TCE has been detected regularly within the unnamed Southwestern Drainage Ditch (sample point UND-SW01) at low levels since 1990 and was detected in 1998 at 2 to 3 μg/L. TCE was also detected downstream from this location at 2 μg/L in the second quarter of 1998. Naturally occurring Sunbury Shale chips and fines in the stream sediment contain trace concentrations of uranium, and these chips might account for the low uranium concentrations that were detected below PRGs at many of the sampling locations in 1998. Gross alpha and beta activity was also detected at several sampling locations, but the activity was below PRGs (DOE 1999a).

3.5 FLOODPLAINS AND WETLANDS

3.5.1 Floodplains

Floodplains consist of mostly level land along rivers and streams that may be submerged by floodwaters. The Flood Insurance Rate Map (FIRM) provided by the Federal Emergency Management Agency (FEMA) indicates that the 100-year floodplain extends on both sides of Little Beaver Creek upstream from the confluence with Big Beaver Creek to the rail spur located near the X-230J-9 North Environmental Sampling Station (Fig. 3.2). The 100-year floodplain ranges on either side of Little Beaver Creek from 15.24 to 60.96 m (50 to 200 ft) roughly following the 174.7-m (575-ft) topographic contour. Flooding is not a problem for the majority of the site. The highest recorded flood level of the Scioto River in the vicinity of the site was 570.0 ft AMSL (January 1913), which is approximately 100 ft below the level of most PORTS facilities. No portion of the floodplain for Big Beaver Creek is located within the PORTS boundary.

3.5.2 Wetlands

The U.S. Army Corps of Engineers (USACE) defines wetlands as “those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Wetlands usually include swamps, marshes, bogs, and similar areas. In identifying a wetland, three characteristics should be met. First, there is the presence of hydrophytic vegetation that has morphological or physiological adaptations to grow, compete, or persist in anaerobic soil conditions. Second, hydric soils are present and possess characteristics that are associated with reducing soil conditions. Third, site hydrology is such that the area is inundated or

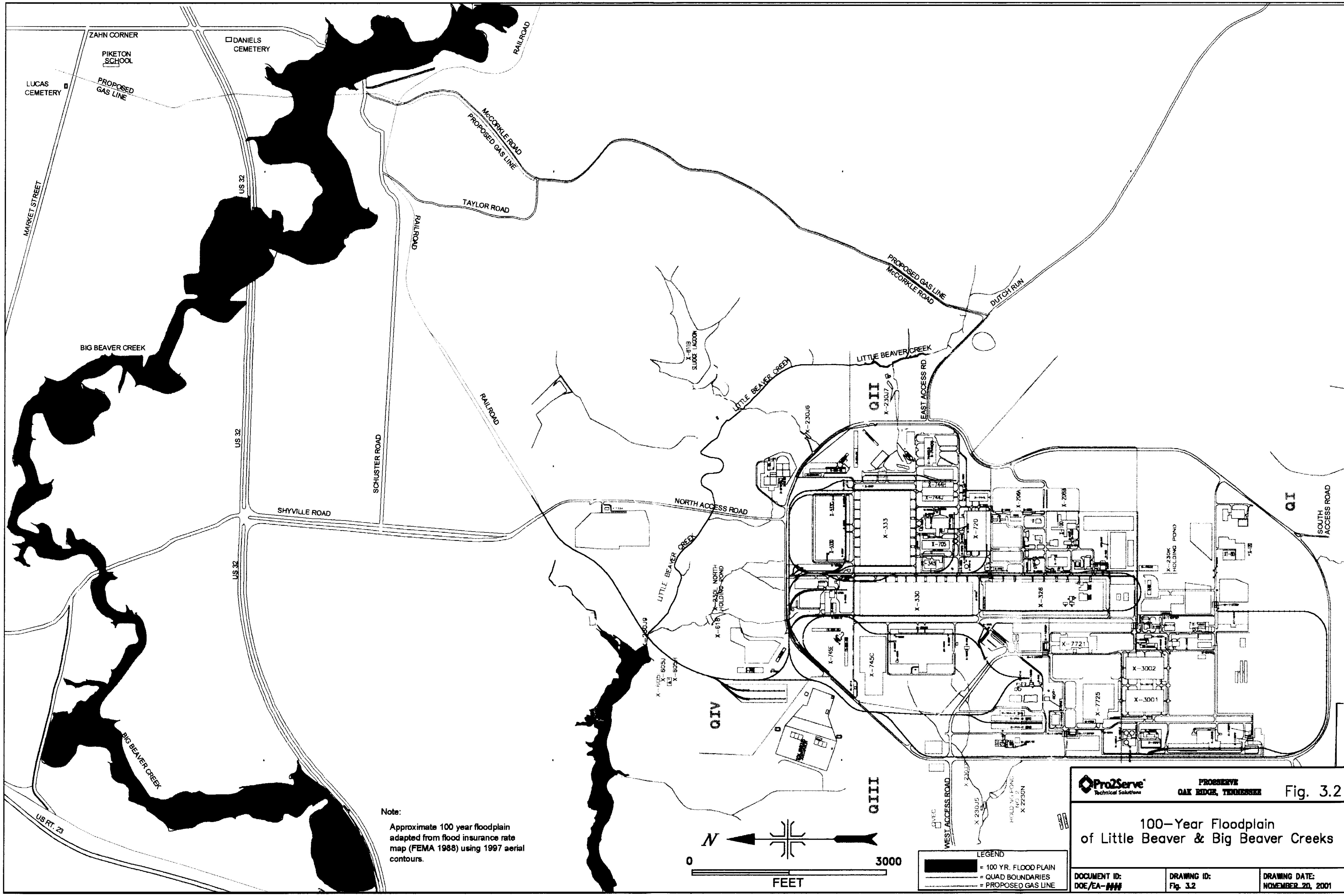


Fig. 3.2

100–Year Floodplain of Little Beaver & Big Beaver Creeks

saturated to the surface at some time during the growing season of the prevalent vegetation. (USACE 1987).

PORTS contains 41 jurisdictional and 4 non-jurisdictional wetlands totaling 13.92 ha (34.36 acres) (DOE 1996b). Quadrant I has 13 jurisdictional wetlands totaling 5.22 ha (12.91 acres). Quadrant II contains three jurisdictional wetlands with a total area of 5.2 ha (12.86 acres). Quadrant III has 6 jurisdictional wetlands totaling 0.82 ha (2.02 acres), and Quadrant IV has 19 jurisdictional wetlands and 4 non-jurisdictional wetlands totaling 2.66 ha (6.58 acres). The majority of the wetlands are associated with wet fields, areas of previous disturbance, drainage ditches, or wet areas along roads and railway tracks. Table 3.2 provides information about the wetlands at PORTS. The location of all the wetlands is shown on Fig. 3.3.

3.6 ECOLOGICAL RESOURCES

3.6.1 Terrestrial Resources

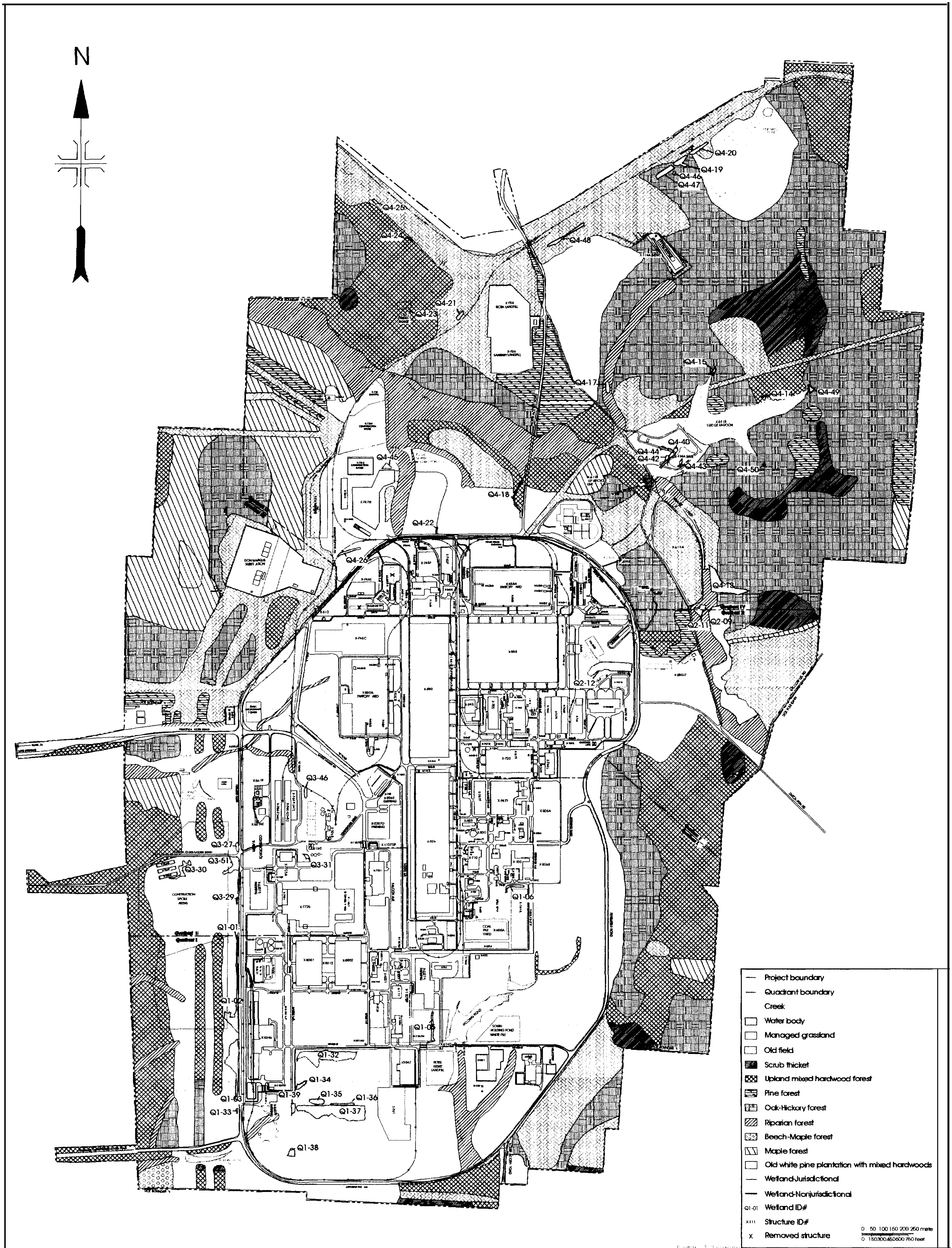
The 10 terrestrial habitat types at PORTS are as follows (DOE 1997a):

- Old field areas—Early successional stage of disturbed areas dominated by tall weeds, shade-intolerant trees, and shrubs
- Scrub thicket—Later successional stage covering old field areas dominated by dense thickets of small trees
- Managed grassland—Open areas actively maintained and dominated by grasses
- Upland mixed hardwood forest—Mesic to dry upland areas dominated by black walnut, black locust, honey locust, black cherry, and persimmon
- Pine forest—Advanced successional stage following scrub thicket. The overstory is dominated by Virginia pine
- Pine plantation—Nearly pure stands of Virginia pines
- Oak-hickory forest—Well-drained upland soils. White oak and shagbark hickory are the most dominant of the oaks and hickories
- Riparian forest—Periodically flooded, low areas associated with streams. Dominated by cottonwood, sycamore, willows, silver maple, and black walnut
- Beech-maple forest—Undisturbed areas dominated by American beech and sugar maple
- Maple forest—Dominated by sugar maple and other shade-tolerant species

Table 3.2. Wetlands at PORTS

Wetland ID #	Status	ha/acre	Location	Comments
QI-01	Jurisdictional	0.133/0.328	West Perimeter Road	
QI-02	Jurisdictional	0.436/1.077	West Perimeter Road	
QI-03	Jurisdictional	0.778/1.922	West Perimeter Road	
QI-05	Jurisdictional	0.105/0.259	X-2207 parking	Drainage ditch
QI-06	Jurisdictional	0.093/0.230	X-749A landfill	Drainage ditch
QI-32	Jurisdictional	1.292/3.189	Former GCEP site	Wet field; former GCEP site
QI-33	Jurisdictional	0.012/0.029	West Perimeter Road	
QI-34	Jurisdictional	0.109/0.269	Former GCEP site	Wet field; former GCEP site
QI-35	Jurisdictional	0.151/0.374	Former GCEP site	Wet field; former GCEP site
QI-36	Jurisdictional	0.051/0.125	Former GCEP site	Wet field; former GCEP site
QI-37	Jurisdictional	1.874/4.626	Former GCEP site	Wet field; former GCEP site
QI-38	Jurisdictional	0.103/0.254	Former GCEP site	Wet field; former GCEP site
QI-39	Jurisdictional	0.092/0.228	Former GCEP site	Wet field; former GCEP site
QII-09	Jurisdictional	4.203/10.378	Little Beaver Creek	
QII-11	Jurisdictional	0.182/0.450	X-611A	Previous disturbance
QII-12	Jurisdictional	0.821/2.028	X-701B area	RAD area
QIII-27	Jurisdictional	0.047/0.117	West Perimeter Road	
QIII-29	Jurisdictional	0.015/0.036	West Perimeter Road	
QIII-30	Jurisdictional	0.194/0.480	X-744 N, P, and Q	Previous disturbance
QIII-31	Jurisdictional	0.042/0.103	X-615	RAD area
QIII-46	Jurisdictional	0.032/0.080	X-616	Drainage ditch
QIII-51	Jurisdictional	0.486/1.201	West Perimeter Road	
QIV-13	Jurisdictional	0.949/2.343	X-611A	Old borrow area
QIV-14	Non-jurisdictional	0.005/0.012	X-611B	Sludge lagoon
QIV-15	Non-jurisdictional	0.046/0.114	X-611B	Sludge lagoon
QIV-17	Jurisdictional	0.093/0.229	Fog Road	Natural area; past disturbance
QIV-18	Jurisdictional	0.130/0.322	North access road	Drainage ditch
QIV-19	Jurisdictional	0.181/0.447	North borrow area	Drainage ditch
QIV-20	Jurisdictional	0.158/0.389	North borrow area	Drainage ditch
QIV-21	Jurisdictional	0.066/0.163	X-735 landfill	Borders railroad track
QIV-22	Jurisdictional	0.007/0.018	X-7456 cylinder yard	Drainage ditch
QIV-23	Jurisdictional	0.024/0.006	Ruby Hollow	Natural area; past disturbance
QIV-24	Jurisdictional	0.018/0.044	Ruby Hollow	Natural area
QIV-25	Jurisdictional	0.038/0.094	Ruby Hollow	Natural area; past disturbance
QIV-26	Jurisdictional	0.065/0.160	X-752 Warehouse	Man-made ditch
QIV-40	Jurisdictional	0.145/0.359	X-611B	Man-made ditch
QIV-42	Jurisdictional	0.047/0.115	X-611B	Base of dam
QIV-43	Jurisdictional	0.048/0.119	X-611B	Base of dam
QIV-44	Jurisdictional	0.068/0.167	X-611B	Base of dam
QIV-45	Jurisdictional	0.08/0.201	X-747H landfill	RAD area
QIV-46	Jurisdictional	0.016/0.040	North borrow area	Borrow area
QIV-47	Jurisdictional	0.202/0.499	North borrow area	Drainage ditch
QIV-48	Jurisdictional	0.228/0.564	North borrow area	Drainage ditch
QIV-49	Non-jurisdictional	0.058/0.142	X-611B	Sludge lagoon
QIV-50	Non-jurisdictional	0.013/0.031	X-611B	Sludge lagoon

GCEP = Gas Centrifuge Enrichment Plant.
ha = hectare.
RAD = radioactive.
Source: Wetland Survey Report for the Portsmouth Gaseous Diffusion Plant, 1996b, POEF-LMES-106.



Pro2Serve Fig. 3.3

Terrestrial and aquatic habitats (including wetlands) located at PORTS

DOCUMENT ID: DOE/EA-1459	DRAWING ID: Fig3-3b.cdr	DRAWING DATE: May 18, 2001

The habitat types covering the largest area on the reservation are managed grassland (30% of total area), oak-hickory forest (17%), and upland mixed hardwood forest (11%). The areas covered by each habitat type are listed in Table 3.3 and shown in Fig. 3.3. Several species of animals have been observed within the PORTS property boundary. A complete list of these species is presented in Appendix B and is summarized in this section.

Table 3.3. Terrestrial habitat types at PORTS

Habitat type	Approximate total area (ha/acre)	Approximate no. of communities	Percent of total area[a]
Managed grassland	446/110	Numerous[b]	30.0
Old field	170/420	10	11.4
Scrub thicket	32/79	10	2.2
Upland mixed hardwood forest	162/400	20	10.9
Pine forest	28/69	10	1.9
Oak-hickory forest	256/632	14	17.2
Riparian forest	62/153	10	4.2
Beech-maple forest	2/5	1	0.1
Maple forest	52/128	7	3.5
Old white pine plantation with mixed hardwoods	2/5	1	0.1

Source: DOE 1997a (DOE/OR/11/1668&D0).
[a]Total site area is 1486 ha (3714 acres). Approximately 252 ha (629 acres, 16.9%) of the total area are covered by buildings, parking lots and roads. The remainder of the total site area contains aquatic habitat.
[B]This habitat is present in many areas interspersed between buildings and paved areas across the plant site.

Forty-nine mammals have ranges that include PORTS. Only 28 of those have been observed on the site. The most abundant mammals include white-footed mouse (*Peromyscus leucopus*) and short-tailed shrew (*Blarina brevicauda*). Larger mammals present include white-tailed deer (*Odocoileus virginianus*), eastern cottontail rabbit (*Sylvilagus floridans*), and opossum (*Didelphis virginiania*) (DOE 1996c).

One hundred and fourteen bird species including year-round residents, winter residents, and migratory species have been observed on-site (DOE 1996c). The species include raptors [red-tailed hawk (*Buteo jamaicensis*)], water birds [mallard (*Anas platyrhychos*) and wood duck (*Aix sponsa*)], game birds [wild turkey (*Meleagris gallopauo*)], and non-game birds [nuthatches (*Sitta* sp.) and wrens (*Troglodytes* sp.)].

Eleven species of reptiles and six species of amphibians have been observed at the facility. The most common reptiles include eastern box turtle (*Terrapene c. carolina*), black rat snake (*Elaphe obsolete obsoleta*), and northern black racer (*Coluber constrictor*). The most common species of amphibians are American toad (*Bufo americanus*) and northern dusky salamander (*Desmognathus fuscus*) (DOE 1996c).

Common orders of insects found at PORTS include Homoptera (cicadas and aphids), Hymenoptera (bees, wasps, and ants), Diptera (flies), Coleoptera (beetles), and Orthoptera (grasshoppers) (Battelle 1976).

3.6.2 Aquatic Resources

Surface water aquatic resources at PORTS include creeks and drainage ditches. Little Beaver Creek and Big Run Creek provide drainage for a large portion of the facility. All aquatic resources at the facility are shown in Fig. 3.3. Sources of surface water are precipitation runoff, groundwater discharge, and effluent from plant processes. Most of the aquatic resources include populations of fish (54 species were collected around the facility), invertebrates, and periphyton. The outflow areas also are known to adversely affect the aquatic community of organisms. Some areas of ditches are devoid of aquatic insects and fish while other areas support only the most pollution-tolerant species.

In 1997, the Ohio EPA (Ohio EPA 1998) assessed Little Beaver Creek and found that non-attainment of the Warmwater Habitat (WWH) designation occurred upstream and immediately downstream from the X-230J7 effluent discharge. Partial attainment was reached 0.97 km (0.6 miles) downstream from the X-230J7 discharge, and in the lower reaches the stream fully attained WWH status. The lack of stream habitat combined with low water flow was determined to be the principal cause of the non-attainment of WWH status in the upper reaches, and not the effluent. The fish communities ranged from fair to exceptional condition in the Little Beaver Creek and ranged from good to exceptional downstream from the X-230J7 discharge. The macroinvertebrate communities ranged from poor to exceptional. Poor ratings were assigned in the upstream areas where low flow or pollution stressed the community. Downstream areas of Little Beaver Creek contained exceptional macroinvertebrate communities and included high taxa diversity and a predominance of pollution-sensitive organisms. The most abundant fish taxa were central stonerollers (*Campostoma anomalum*), creek chubs (*Semotilis atromaculatus*), and bluntnose minnows (*Pimephales notatus*).

Big Run Creek is a typical headwater stream for the area. Prior to the relocation of 304.8 m (1000 ft) of the stream channel in 1994, it contained seven species of fish dominated by creek chubs and central stonerollers (Ohio EPA 1993). Macroinvertebrates consisted of chironomids, fly larvae, mayflies, stoneflies, caddisflies, beetles, damselflies, aquatic earthworms, and planaria (ERDA 1977).

The drainage ditches have not been well studied in the past. An unnamed western tributary has three species of fish typically associated with headwaters and contains fly larvae, caddisflies, beetles, and snails (ERDA 1977). Tributaries in the northwestern and southwestern portions of the facility have not had bioassessments performed on them.

3.6.3 Threatened and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) and the Ohio Department of Natural Resources (ODNR), Division of Natural Areas and Preserves, provided information regarding threatened and endangered species at PORTS. Also, a comprehensive evaluation of the site for the presence of federal- and state-listed threatened and endangered species was conducted in 1996 (DOE 1997a). The USFWS has indicated that the Indiana bat (Myotis sodalis) is the only federally listed endangered animal species whose home range includes PORTS. Information from USFWS and ODNR identified several state-listed threatened, endangered, and special interest species within 1 mile of the facility; however, their database does not show any species within the property boundaries of the facility.

Surveys were conducted for the presence of the Indiana bat in 1994 and 1996. As part of the 1996 survey, potential summer habitat for the Indiana bat was identified in the Northwest Tributary stream corridor, the Little Beaver Creek stream corridor, and along a logging road in a wooded area to the east of the X-100 facility. Mist netting was conducted in those areas in June and again in August. Although 14 bats representing four common species were captured during the August survey, no Indiana bats were collected. The survey also indicated that most of PORTS has poor summer habitat for Indiana bats. The few woodlands that occur on the property are small, isolated, and not of sufficient maturity to provide good habitat. The exception is an area of deciduous sugar maple forest along the Northwest Tributary stream corridor, where several of the bats were collected (DOE 1997a). The Northwest Tributary begins just southwest of the Don Marquis substation and flows approximately 3200 ft before leaving the DOE property prior to its confluence with Little Beaver Creek.

The timber rattlesnake has been identified as a proposed candidate species for the Federal endangered species list. Although none have been observed at the site, PORTS is included in the range of this species. It is also listed as endangered by the State of Ohio.

Historically, isolated sightings and observations of threatened, endangered, or special interest species have occurred at the facility. An Ohio endangered raptor, sharp-shinned hawk (*Accipiter striatus*), has been observed at the site in the past (DOE 1993). One Ohio endangered plant species, Carolina yellow-eyed grass (*Xyris difformis*), and a potentially threatened species, Virginia meadow-beauty (*Rhexia virginica*), have been found at the facility (DOE 1993; DOE 1996c). The rough green snake (*Opheodrys aestivus*), listed as an Ohio special interest species, has been observed at PORTS (DOE 1996c).

3.6.4 Environmentally Sensitive Areas

There are several environmentally sensitive areas within PORTS. These include areas where Ohio endangered or threatened species have been observed and wetland areas and the floodplain of Little Beaver Creek. There are no exceptional warm water streams within the facility.

- The Northwest Tributary stream corridor is considered a sensitive area because it represents the best habitat for bats at PORTS.

- The area near the X-611B sludge lagoon should be considered a sensitive area due to the possible presence of Carolina yellow-eyed grass, which was observed at PORTS in 1994 (DOE 1996b). Confirmation of this species is necessary, as the original identification occurred while the plant was not flowering.

- The area near the X-611A lagoon is a sensitive area because of the presence of Virginia meadow-beauty (*Rhexia virginica)* adjacent to the base of the dike. Wetlands also are present in this area.

None of these environmentally sensitive areas would be affected by the proposed action. There are no state or national parks, forests, conservation areas, wild and scenic rivers, or other areas of recreational, ecological, scenic, or aesthetic importance within the immediate vicinity of PORTS. A PORTS site picnic area and two greenways have been licensed to local entities as part of community development and are in the planning stages.

The DOE Seal Township-Ruby Hollow Greenway is located on the northeastern quarter of the PORTS site; this greenway will not be impacted by the proposed action.

The DOE Scioto Township-Davis Greenway is located on the southeastern quarter of the PORTS site; the low-pressure 100-psi natural gas pipeline would be located on the western edge of the greenway property within approximately 100 ft of the center of Perimeter Road. The proposed action would pose no detrimental impact on the use of the property as a greenway.

The recreational park/picnic area is located south and east of the DOE Scioto Township-Davis Greenway, also in the southeastern quarter of the PORTS site. The site of the recreational park/picnic area and this site will not be impacted by the proposed action.

3.7 CULTURAL RESOURCES

Cultural resources are defined as any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. When these resources meet any one of the National Register Criteria for Evaluation (NRCE) (36 *CFR* Part 60.4), they may be termed historic properties and thereby are potentially eligible for inclusion in the National Register of Historic Places (NRHP).

Several draft cultural resource surveys have been prepared for DOE PORTS and will be evaluated in conjunction with the Ohio State Historic Preservation Office (SHPO) to determine properties that are eligible for inclusion in the NRHP.

3.7.1 Archaeological Resources

PORTS is located within a region where Adena and Hopewell Indian mounds have existed. Additionally, several historic Native American Indian tribes are known to have had villages nearby.

Two preliminary Phase I archaeological surveys (Dobson-Brown et al. 1996; Schweikart et al. 1997) have been completed at PORTS. The combined surveys covered 836 ha (2066 acres) in Quadrants I through IV. There are few prehistoric archaeological resources at PORTS. Whether this is indicative of the local prehistoric upland settlement pattern or is a consequence of the extensive land disturbance associated with PORTS is not known. In contrast, historic archaeological resources in PORTS are relatively abundant, conspicuous, and undisturbed due to the nature and development of the facility.

Dobson-Brown et al. (1996) developed a predictive model of archaeological resource locations at PORTS based on variations in modern plant communities, topography, and soils, and on the location of previously identified archaeological resources in a 6.5-km (4-mi.) literature review study area radius around the facility.

Survey methods in Quadrants I and II included visual inspection, surface collection, and hand excavation of shallow, <13 cm (<5 in.), shovel test pits. Similar shovel test pits inside the Perimeter Road area did not identify archaeological resources and indicated that this area has been highly disturbed.

Survey methods in Quadrants III and IV consisted of visual inspection, surface collection, hand-excavated shovel tests to 30 cm (12 in.) in depth in high-probability areas lacking significant disturbance and <15% slope. Additionally, hand-excavated deep shovel tests (>30 cm or 12 in.) were accompanied by 2-cm (0.75-in.)-diameter hand-coring in three areas in Quadrant IV along Little Beaver Creek. Portions of Quadrants I and II that were not investigated during the preliminary Phase I archaeological survey were also investigated by shallow shovel tests.

The combined Phase I archaeological surveys identified 38 archaeological resources (Tables C.1, C.2, and C.3) (see Appendix C). Nine of the resources contain prehistoric components. Five are identified as prehistoric isolated finds. Two are identified as prehistoric lithic scatters. Two contain prehistoric and historic components: a prehistoric isolated find in an historic cemetery and a prehistoric lithic scatter and historic farmstead. These sites are located in Quadrants I, II, and IV. No archaeological resources have been identified in Quadrant III. Thirty of the archaeological resources are associated with historic-era properties located within PORTS. Fifteen are remnants of historic farmsteads. Seven are scatters of historic artifacts or open refuse dumps. Two are isolated finds of historic artifacts. Four are remnants of PORTS structures. Two are historic cemeteries. One of the historic cemeteries has an associated chapel and remnant of a PORTS observation tower.

The draft cultural resource report (Schweikart et al. 1977) determined that 22 of the archaeological resources do not meet the NRCE (Table C.1) (see Appendix C). Insufficient data were collected at the remaining 14 archaeological components and two historic-era cemeteries, one of which (33 Pk 189; PIK-206-9) includes an associated historic archaeological component, to determine whether they meet the NRCE (Tables C.2 and C.3) (see Appendix C).

3.7.2 Architectural Historic Resources

Two architectural historic surveys have also been completed at PORTS (Dobson-Brown et al. 1996; Coleman et al. 1997). The combined surveys covered 1501 ha (3708 acres) and identified several structures that may have historical significance at PORTS (Table C.4) (see Appendix C).

A draft historic context for PORTS has also been prepared. This historic context is broken into four development periods for PORTS: Development Period 1 which includes pre-PORTS facilities, Development Period 2 which includes original PORTS facilities, Development Period 3 which includes PORTS facility additions, and Development Period 4 which includes GCEP facilities. In the draft architectural survey report (Coleman et. al. 1997), recommendations were made concerning which buildings and structures were considered contributing and noncontributing resources to the PORTS historic property. DOE will evaluate these recommendations in conjunction with the Ohio State Historic Preservation Office (SHPO) to determine which buildings and structures are considered historic properties under the National Historic Preservation Act (NHPA) and whether any of the properties are eligible for inclusion in the NRHP.

3.8 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The region of influence (ROI) for the PORTS analysis includes Jackson, Pike, Ross, and Scioto Counties, Ohio. The ROI includes the city population centers of Portsmouth, Chillicothe, and Jackson, as well as several rural villages such as Piketon, Wakefield, and Jasper (Fig. 3.4.).

3.8.1 Demographic Characteristics

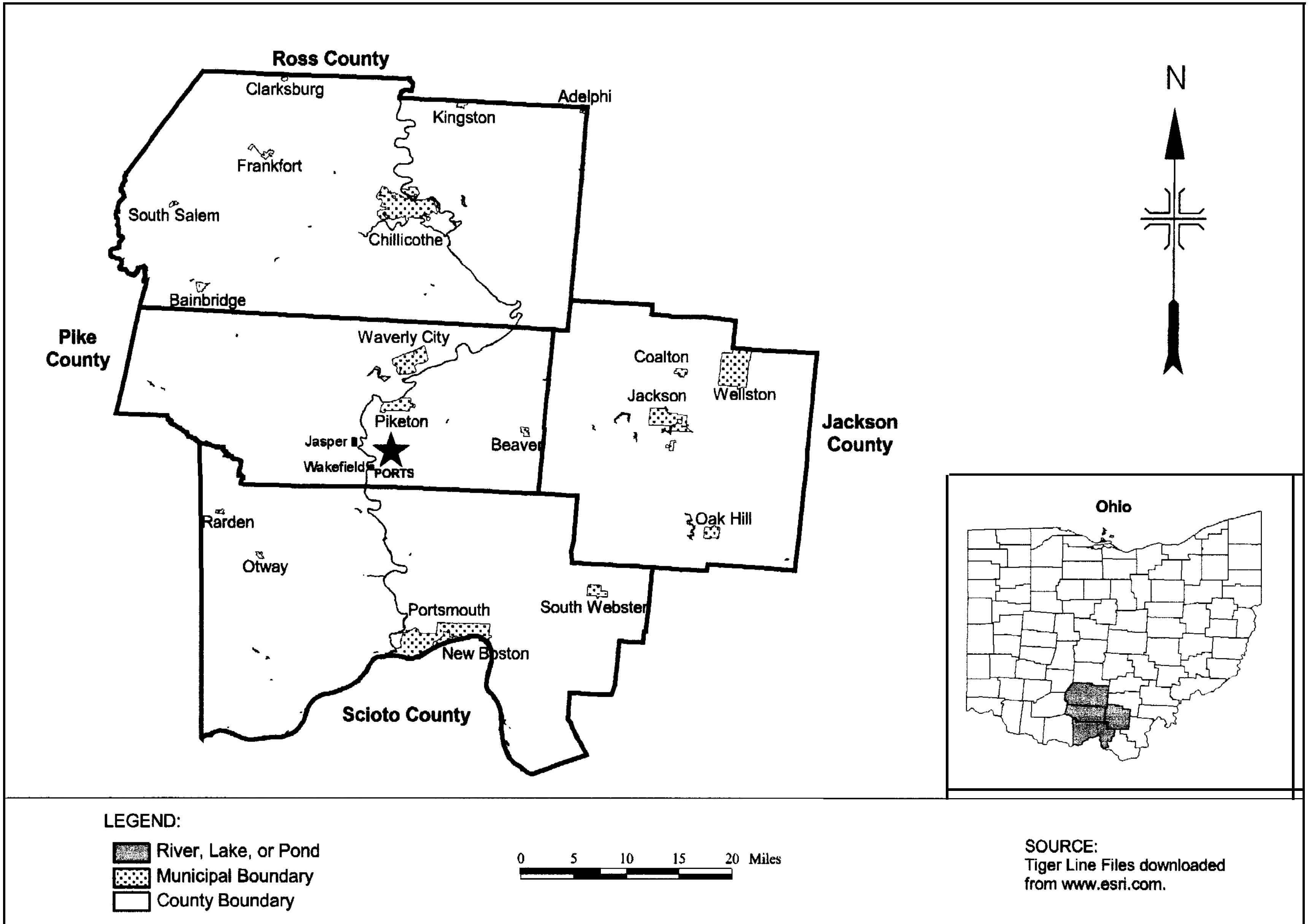
3.8.1.1 Population

Population trends and projections for each of the counties in the ROI are presented in Table 3.4. Of the four counties, Scioto and Ross Counties have the largest populations, accounting for 37% and 35%, respectively, of the region's 1997 population. Jackson County accounts for 15%, and Pike County for the remaining 13%. The Ohio Department of Development (ODOD) projects that the population in the region will grow very slowly, increasing by less than 7% between 1997 and 2010 (ODOD 1999).

Table 3.4. PORTS ROI regional population trends and projections

County	1990	1997	2000	2010
Jackson	30,238	32,455	32,900	35,000
Pike	24,362	27,530	27,140	29,380
Ross	69,455	75,168	74,800	81,700
Scioto	80,385	80,744	82,500	84,700
Region	204,440	215,897	217,340	230,780
State	10,861,801	11,237,752	11,288,760	11,738,930

Sources: Bureau of Economic Analysis, 1999; ODOD, 1999.



Pro2Serve Fig. 3.4	Region of influence for PORTS.	DOCUMENT DOE/EA-1459	DRAWING ID: Fig3-4a Q2EA	DRAWING I May 18, 200

3.8.1.2 Minority and economically disadvantaged populations

The distribution of minority and economically disadvantaged populations was studied to address environmental justice concerns. Table 3.5 presents the distribution of minority populations by county in the four-county ROI. For the purposes of this analysis, a minority population consists of any area in which minority representation is greater than the national average of 24.2%. Minorities include individuals classified by the U.S. Bureau of the Census as Negro/Black/African-American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, or Aleut. Since Hispanics may be of any race, nonwhite Hispanics are included only in the Hispanic category, and not under their respective minority racial classifications. In all four counties, minority populations are smaller than the national average, ranging from a high of 8.9% in Ross County to a low of 1.2% in Jackson County (ODOD 1999).

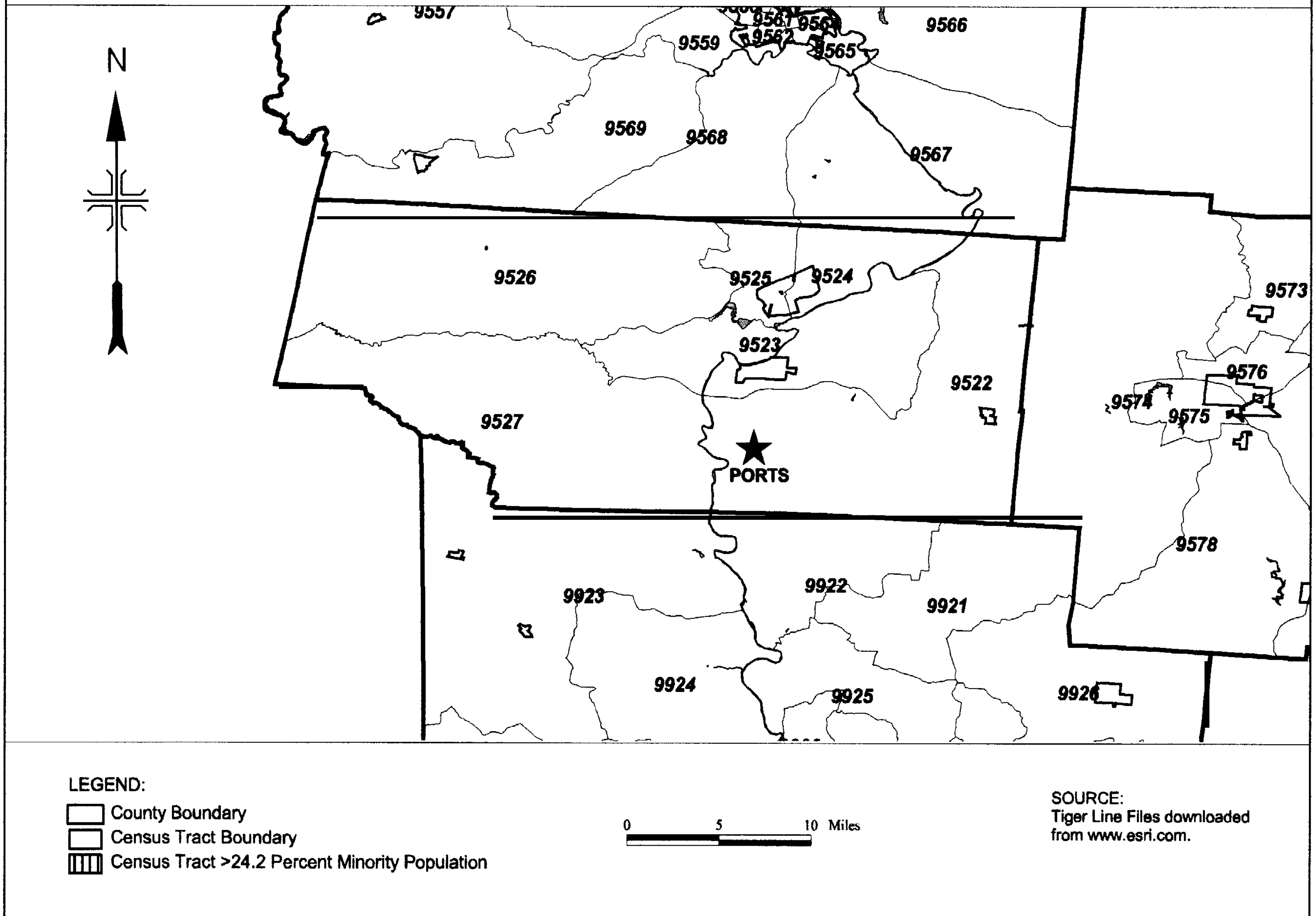
Table 3.5. PORTS ROI distribution of minority populations, 1998

	Jackson		Pike		Ross		Scioto	
Race/ethnic group	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
White	32,159	98.4	27,185	97.4	69,246	91.2	77,647	96.2
Black	270	0.8	433	1.6	5618	7.4	2079	2.6
Asian/Pacific Islander	74	0.2	74	0.3	420	0.5	200	0.3
American Indian	60	0.2	83	0.3	189	0.2	429	0.5
Hispanic (any race)	129	0.4	112	0.4	492	0.7	337	0.4
Total	32,692	100.0	27,887	100.0	75,965	100.0	80,692	100.0

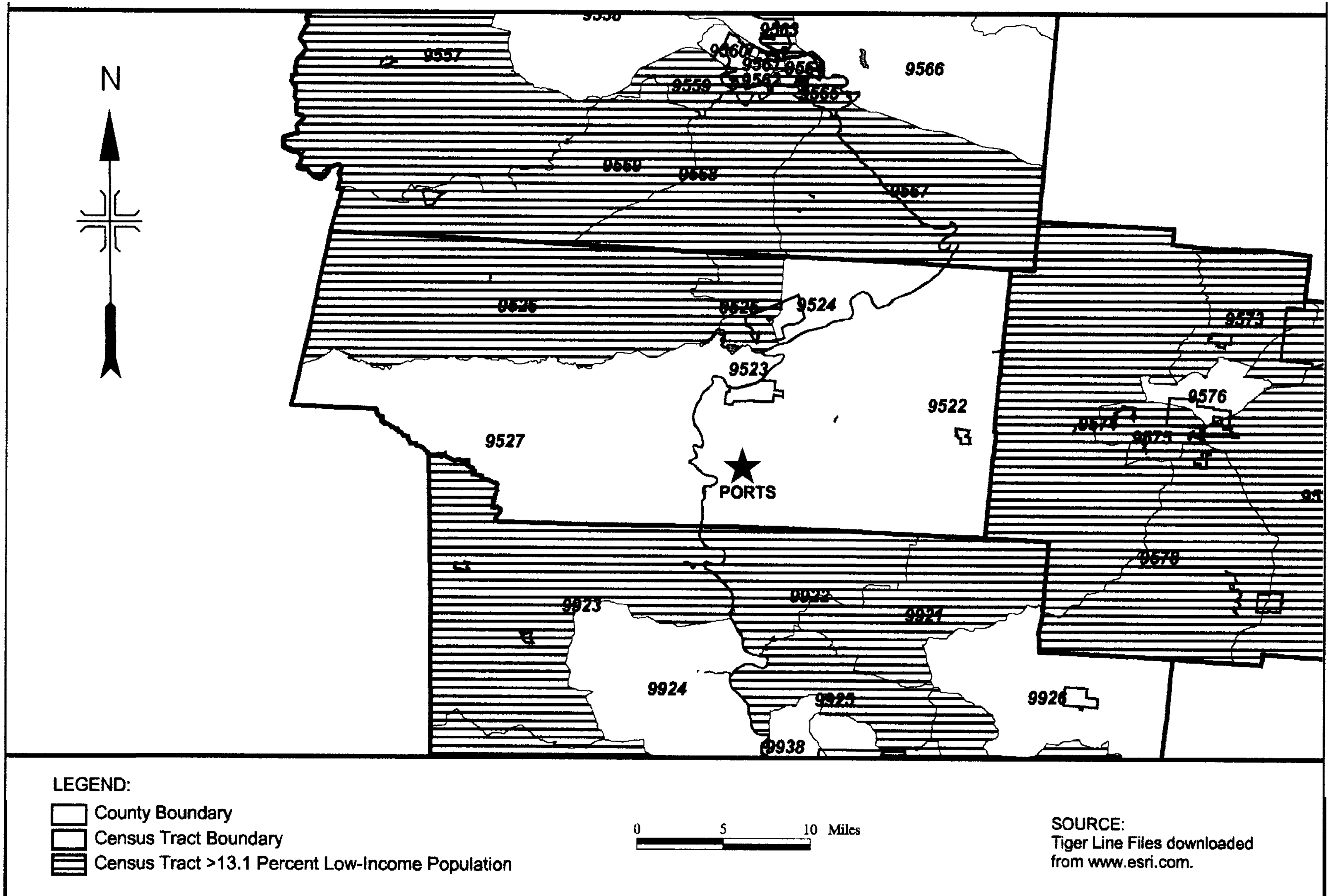
Source: ODOD, 1999.

Since any adverse health or environmental effects are likely to fall most heavily on the individuals nearest PORTS, it is also important to examine the populations in the closest census tracts. Fig. 3.5 illustrates the distribution of minority populations in the census tracts that immediately surround the PORTS plant. As of the 1990 Census, none of the tracts closest to the site had minority representation greater than the national average of 24.2% (Bureau of the Census 1990a). In Pike County, tract 9522 contained the largest proportion of minority residents at 4.9%. Only one census tract within the ROI includes a minority population; minorities represent 26.1% of the population in tract 9937 in Scioto County (not shown in Fig. 3.5). This tract is near the center of the city of Portsmouth, approximately 37 km (23 miles) south of PORTS.

Table 3.6 presents the proportion of individuals with income below the poverty level, by county, in the four-county ROI. Figure 3.6 shows the location of low-income populations for the same area. In this analysis, a low-income population includes any census tract in which the percentage of persons with income below the poverty level is greater than the national average of 13.1% (Bureau of the Census 1990b). The Ohio average in 1990 was 12.5%. Nearly all (41 out of 48) of the census tracts in the four-county area qualify as low-income populations (Bureau of the Census 2000). The percent of persons below the poverty level ranges as high as 51.0% for tract 9936 in Scioto County (not shown in Fig. 3.6). In Pike County, the proportion ranges from 10.8% in tract 9524 to 33.9% in tract 9527.



Pro2Serve	Fig. 3.5	Census tracts with minority population proportions greater than the national average of 24.2%.	DOCUMENT ID: DOE/EA-1459	DRAWING ID: Fig3-5a Q2EA.cdr	DRAWING DATE: May 18, 2001



Pro2Serve | **Fig. 3.6** | Census tracts with low-income population proportions greater than the national average of 13.1%.

DOCUMENT ID: DOE/EA-1459 | DRAWING ID: Fig3-6c Q2EA.cdr | DRAWING DATE: May 18, 2001

Table 3.6. Proportion of individuals with income below poverty level: PORTS ROI, 1989 and 1995

Area	Percent 1989	Percent 1995
Jackson County	24.2	17.5
Pike County	26.6	19.5
Ross County	17.7	15.1
Scioto County	25.8	21.4
State of Ohio	12.5	12.5
United States	13.1	13.1

Source: ODOD, 1999; Bureau of the Census, 1990b.

3.8.2 Employment

Regional employment data for 1992 and 1997 are summarized in Table 3.7. While total employment grew more than 16% during the 5-year period, unemployment rates within the region remained high. As Table 3.8 shows, the 1999 average unemployment rate for the ROI was 7.0%, compared to a statewide average of only 4.3%. Unemployment rates for individual counties ranged from 8.6% in Pike County to 5.2% in Ross County (Bureau of Labor Market Information 2000). Data for previous years show a persistent pattern of high unemployment rates throughout the region.

Table 3.7. PORTS ROI employment, 1992 and 1997

County	1992	1997	Percent change
Jackson	12,240	14,017	14.52
Pike	10,506	13,930	32.59
Ross	29,428	33,944	15.35
Scioto	28,802	32,218	11.86
Region	80,976	94,109	16.22
Ohio	5,906,639	6,596,769	11.68

Source: Bureau of Economic Analysis, 1999.

Table 3.8. PORTS ROI annual average unemployment, 1999

County	Employed	Unemployed	Total	Unemployment rate (%)
Jackson	13,600	1,000	14,600	6.8
Pike	10,600	1,000	11,600	8.6
Ross	32,900	1,800	34,700	5.2
Scioto	30,100	2,800	32,900	8.5
Total	87,200	6,600	93,800	7.0
Ohio	5,503,000	246,000	5,749,000	4.3

Source: Bureau of Labor Market Information, 2000.

In 1997, 2340 (91%) of the 2550 DOE-related workers lived in the four-county impact region (SODI 1997). These workers represented about 2.6% of the total ROI employment shown in Table 3.7. Table 3.9 shows the distribution of DOE-related employment across the ROI counties for that year. Scioto County held the largest share of the region's DOE-related employment with 51%, followed by Pike County with 23% and Ross County with 15%. Jackson County accounted for the remaining 10%.

Table 3.9. Distribution of DOE-related employment in ROI, 1997

County	1997 Employment	Percent
Jackson	244	10
Pike	544	23
Ross	362	15
Scioto	1190	51
Region	2340	99

Source: SODI, 1997.

Currently the total site employment at PORTS is approximately 1868. USEC employs about 1415 people while DOE, BJC, and various subcontractors employ approximately 644 people.

3.8.3 Income

Between 1992 and 1997, total regional income grew by 27% from approximately $2.9 billion to nearly $3.7 billion (Bureau of Economic Analysis 1999). Per capita income data for the region and the state are shown in Table 3.10. Per capita income in all four counties was well below the state average in both 1992 and 1997, continuing a long established trend. From 1992 to 1997, per capita incomes in the relevant counties grew between 19 and 25%, compared to a statewide increase of 24%. In 1997, it was estimated that PORTS accounted (directly and indirectly) for about $185 million of that income, about 5% of the total. The share of wages and salaries in individual counties ranged from 2.4% in Ross County to 15.2% in Pike County (Henderson 1997).

Table 3.10. Measures of per capita income for the PORTS ROI

Area	Per capita income 1992 ($)	Per capita income 1997 ($)	Percent increase
Jackson County	13,245	16,392	24
Pike County	13,292	15,783	19
Ross County	14,896	17,900	20
Scioto County	13,422	16,824	25
State of Ohio	19,482	24,163	24

Source: Bureau of Economic Analysis, 1999.

3.8.4 Housing

In 1990 vacancy rates in the region ranged between a low of 7% in Ross County to a high of 10% in Jackson County (Bureau of the Census 2000). Among all occupied housing units in the region, approximately 70% were owner occupied. The median home value was similar in all four counties, ranging between $37,000 and $49,600. Rents ranged from $281 to $317 across the ROI (Table 3.11).

Table 3.11. Housing summary for the PORTS ROI, 1990, by county

	Jackson County		Pike County		Ross County		Scioto County	
	Number	%	Number	%	Number	%	Number	%
Total housing units	12,452	100	9,722	100	26,173	100	32,408	100
Occupied	11,260	90	8,805	91	24,325	93	29,786	92
Vacant	1,192	10	917	9	1848	7	2,622	8
Median home value	$38,700	NA	$42,600	NA	$49,600	NA	$37,000	NA
Gross rent	$283	NA	$297	NA	$317	NA	$281	NA

NA = Not applicable

Source: U.S. Bureau of the Census, 2000; U.S. Bureau of the Census, 1990a.

3.8.5 Education

Summary figures for the school districts within the four-county ROI are shown in Table 3.12. The highest per-student expenditures occur in Scioto County, which spent an average of $5849 per student during the 1997 and 1998 school year (ODOD 1999).

Table 3.12. Public school statistics in the PORTS ROI, 1997 and 1998 school year

County	Number of Schools	Student enrollment[a]	Teachers[a]	Teacher/student Ratio	Per-student Expenditures
Jackson	17	6,020	347	1:17	$5,082
Pike	13	5,861	320	1:18	$5,385
Ross	30	12,444	691	1:18	$5,544
Scioto	37	14,549	923	1:16	$5,849

[a]Full-time equivalent figures, public schools only.
Source: ODOD, 1999.

3.8.6 Health Care

There are three general hospitals currently serving the region. Average statistics for the hospitals indicate that there are approximately 442 routine-care hospital beds in the region, about 53% of which are available on any given day. This capacity is considered adequate to serve the health needs of the local population (The American Hospital Directory 1999).

3.8.7 Police and Fire Protection

The Protective Forces at PORTS provide physical security services at the site. However, the Pike County Sheriff provides limited patrols of Perimeter Road. USEC and DOE both have mutual aid agreements for fire protection, emergency squad, and medical services, primarily with Scioto Township and Seal Township. The Seal Township fire department plans to add a second fire station to better protect the nearby Zahn's Corner Industrial Park. Exercises/drills involving all area protective forces are conducted annually.

3.8.8 Fiscal Characteristics

The State of Ohio imposes an income tax, and the state constitution requires that at least 50% of the income tax collected from individuals be returned to the county of origin. Transfers back to the county are distributed as follows: 4.2% to the local government fund, 0.6% to the local government revenue assistance fund, 5.7% to the library and local government support fund, and 89.5% to the general revenue fund of the county. Ohio law allows the imposition of a local sales tax on retail sales, the rental of tangible personal property, and selected services. The local permissive sales tax is 1.5% in Ross County, and 1.0% in each of the other three counties. Intergovernmental transfers back to the county in which the tax is collected are distributed as follows: 4.2% to the local government fund and 0.6% to the local government revenue assistance fund.

There is also an optional tangible personal property tax on machinery, equipment, and inventories. Revenue is distributed to the counties, municipalities, townships, school districts, and special districts according to the taxable values and total mileage levied by each. For the state as a whole, school districts receive roughly 70% of the total tangible personal property tax collected (Henderson 1997).

In 1997, Henderson estimated that activities at PORTS and wages paid to its employees accounted for $3.2 million in tax revenues returned to the region, including $2 million from income taxes and $1.2 million from sales taxes (Henderson 1997).

3.9 INFRASTRUCTURE AND SUPPORT SERVICES

3.9.1 Transportation

PORTS is served by Southern Ohio's two major highways: U.S. Route 23 and Ohio State Route 32 (Fig. 1.1). These highways are located within 1.6 km (1 mile) of the site. Access is by the Main Access Road, a four-lane interchange with U.S. Route 23, and the North Access Road, two lanes transitioning to four lanes with an at-grade interchange with Ohio State Route 32. These access routes easily accommodate PORTS traffic flow. The site is 5.6 km (3.5 miles) from the intersection of the U.S. Route 23 and 32,159d Ohio State Route 32 interchange. Both routes are four lanes with U.S. Route 23 traversing north–south and Ohio State Route 32 traversing east–west. Two other access routes also serve the site. The East Access Road is a two-lane county road that disperses traffic to a county road network east and southeast of PORTS. Access to Ohio State Route 32 is also available by this network. South Access Road is also a two-lane road that disperses traffic to the south and southeast. South Access Road also intersects U.S. Route 23 south of the site. Approximately 113 km (70 miles) north of the site, U.S. Route 23 intersects I-270, I-70, and I-71. Trucks also may access I-64 approximately 32.2 km (20 miles) southeast of Portsmouth.

North Access Road has a daily traffic load of approximately 2383 vehicles. East Access Road has a daily traffic load of 802 vehicles. South Access Road has a daily traffic load of 1579 vehicles. The Main Access Road has a daily traffic load of 592 vehicles. (Traffic in both directions is included in these values.) These roads are congested during shift change; however, traffic flows at posted speed limits and a projected 40% increase in vehicles are feasible without staggering shifts or upgrades to roads. These data were provided by the Pike County Engineer's office from a 1999 traffic study. Load limits on these routes are controlled by the Ohio Revised Code at 85,000-lb gross vehicle weight. Special overload permitting is available.

U.S. Route 23 has an average daily traffic volume of 13,990 vehicles. Ohio State Route 32 has an average daily volume of 7420 vehicles (traffic in both directions is included in these values). U.S. Route 23 is at 60% of design capacity with Ohio State Route 32 at 40% of design capacity. The Ohio Department of Transportation supplied this data from a 1999 traffic study. Load limits on these routes is controlled by the Ohio Revised Code at 85,000-lb gross vehicle weight. Special overload permitting is available.

The PORTS road system is in generally good condition due to frequent road repaving projects. Except during shift changes, traffic levels on the site access roads and Perimeter Road are low. Peak traffic flows occur at shift changes and the principal traffic problem areas during peak morning/afternoon traffic are at locations where parking lot access roads meet the Perimeter Road. The site has 12 parking lots varying in capacity from approximately 50 to 800 vehicles. Total parking capacity is for approximately 4400 vehicles.

PORTS has excellent rail access, and several track configurations are possible within the site. The Norfolk Southern rail line is connected to the CSX main rail system via a rail spur entering the northern portion of the site. The on-site system primarily is used for the movement of large uranium hexafluoride (UF_6) cylinders on flatcars. Primary tracks that handle UF_6 cylinder traffic are maintained in good condition by USEC. The secondary tracks within the site receive minimal attention. The GCEP area is also connected to the existing rail configuration. Track in the vicinity of Piketon, Ohio, allows a maximum speed of 96.6 km/h (60 mph). The CSX system also provides access to other rail carriers.

PORTS can be served by barge transportation via the Ohio River at the ports of Wheelersburg, Portsmouth, and New Boston. The Portsmouth barge terminal bulk materials handling facility is available for bulk materials and heavy unit loads. All heavy unit loading is by mobile crane or barge-mounted crane at an open air terminal. The Ohio River provides barge access to the Gulf of Mexico via the Mississippi River or the Tennessee–Tombigbee Waterway. Travel time to New Orleans is 14 to 16 d; to St. Louis, 7 to 9 d; and to Pittsburgh, 3 to 4 d. The U.S. Army Corp of Engineers (USACE) maintains the Ohio River at a minimum channel width of 243.8 m (800 ft) and a depth of 2.74 m (9 ft).

PORTS is relatively isolated from commercial air service. There are 14 major carriers that provide 300 flights per day to 89 cities serving the Greater Cincinnati International Airport, which is 160.9 km (100 miles) to the west. The Port of Columbus International Airport (160.9 km or 100 miles north) is served by 17 airlines providing 250 flights daily. The Tri-State Airport (88.5 km or 55 miles southeast), Huntington, West Virginia, is served by 4 airlines and 18 flights per day. The Portsmouth Regional Airport, serving private and charter aircraft is 30.58 km (19 miles) southeast, near Minford, Ohio. The Pike County Airport, located near Piketon, is a small facility for private planes. The Pike County Aviation Authority has proposed a capital improvement program to improve and enhance airport services.

3.9.2 Utilities

3.9.2.1 Electricity and natural gas

PORTS is supplied electricity by the Ohio Valley Electric Corporation (OVEC) under a long-term contract that ends in 2003. OVEC operates two coal-fired power plants (Kyger Creek and Clifty Falls on the Ohio River) that were built for and dedicated to serving PORTS. According to the DOE-USEC Lease Agreement, DOE continues to administer the power contracts that supply electric service to PORTS. USEC pays DOE for purchased power, which in turn pays the power suppliers who are under an existing contract.

There are four switchyards on the site. The Don Marquis Substation, which covers approximately 10.52 ha (26 acres) on the crest of a hill northwest of Perimeter Road, is a high-voltage station operated and maintained by the OVEC. High-voltage electrical power (345 kV) is received from overhead power lines at the X-533 and X-530 switchyards. High-voltage oil circuit breakers and gas circuit breakers provide line switching capability and fault protection, and large oil-filled transformers step down the power to 13.8 kV. Air circuit breakers at the X-533 and X-530 switch houses provide protection and control for the numerous 13.8-kV distribution feeders leading to the GDP process buildings, auxiliary buildings, and substations. Construction in the GCEP area included additional 345-kV circuit breakers in the northern section of the X-530 switchyard. The newer high-voltage breakers and existing X-530 breakers feed 345 kV to the X-5000 switchyard through oil-filled 345-kV underground feeder cables. The switching arrangement provides a highly reliable source of power for GCEP. At X-5000, oil-filled 345/13.8-kV transformers feed power to the 13.8-kV air circuit breakers in the X-5000 switch house that control and protect the distribution circuits serving the GCEP area facilities.

The various high-voltage overhead power lines connecting Don Marquis, X-530, and X-533 with each other and with the external power grid are owned and maintained by OVEC. The underground high-voltage system of the underground 345-kV feeders from X-530 to X-5000 are owned by DOE and leased to USEC.

Power is distributed from X-533 to X-333 and from X-530 to X-330 through 13.8-kV distribution cables. Some cables run through underground duct banks, and some are supported by aboveground cable trays. The feeder cables from X-530 to X-326 are all located in underground duct banks. Most of the major GDP facilities receive 13.8-kV power through underground duct banks. A 13.8-kV overhead power system supported by wooden poles provides power to the well fields, sanitary landfill, X-611 water treatment plant, several warehouses, and several other facilities. A 2400-V overhead system provides power for street lighting and security fence lighting.

Natural gas is not currently provided at the plant site although a project is currently underway to construct a natural gas pipeline to the site which is projected to be complete in 2002. This line is intended to primarily feed newly installed hot water boilers installed in the X-3002 Building. These boilers were installed to replace a portion of the heat source (Recirculating Heating Water or RHW) lost when the gaseous diffusion equipment was placed in cold standby. Small amounts of fuel oil are used. Several outlying buildings are not supplied by the steam or the X-3002 boiler systems. These buildings are space heated with fuel oil.

3.9.2.2 Steam distribution system

Steam is used in gaseous diffusion operations to vaporize UF_6, obtain UF_6 samples from cylinders, maintain process temperatures, clean equipment, heat sanitary water, and provide heat for process and support operations. During the fall and winter months, some steam also is used for space heating.

Steam is generated at the X-600 Steam Plant, which contains three coal-fired boilers and electrostatic precipitators, each capable of providing steam at 56,699 kg/h (125,000 lb/h) at 125 psi. The steam plant contains the normal support equipment for boiler operation such as coal and ash handling equipment and boiler feedwater treatment equipment. Coal is stored in the adjacent X-600A Coal Pile Yard. All runoff from the coal yard and wastewater effluents from the steam plant are treated for pH adjustment and heavy metal removal at the X-621 Coal Pile Runoff Treatment Facility. Treated effluent flows into the South Holding Pond. Sludge generated at X-621 is buried in the X-735 Landfill. The coal supplier hauls coal ash off-site under a contractual agreement.

Steam is distributed to most major GDP facilities through aboveground insulated pipes. Parallel piping is provided to return condensate to the X-600. Steam usage within the GCEP area is minimal. Steam and condensate return piping in this area is aboveground with a single 15.24-cm (6-in.) supply line tapped into both the east and west supply headers at the X-600.

3.9.2.3 Water systems

PORTS requires a reliable supply of large amounts of water for process cooling, fire protection, and sanitary use. During plant construction, the X-605G Well Field and the X-605H Booster Station were installed to supply water for construction and for subsequent sanitary consumption. From plant startup in 1955 until 1965, water was routinely taken from the Scioto River at the X-608 Pumphouse, 6.44 km (4 miles) northwest of the site, and transported through a single 120-cm (48-in.) reinforced concrete pipeline to the site.

Additional well fields were constructed to supply high-quality groundwater as a substitute for the poorer quality river water. However, the capability of pumping river water was retained for emergency use. The X-608A Well Field entered service in 1965, and the X-608B Well Field followed in 1975. Both are adjacent to the X-608 Pumphouse. Water flows from these well fields to the X-611 Water Treatment Plant on the site through the 120-cm (48-in.) concrete pipeline. Water from the original well field, X-605G, flows through a 25-cm (10-in.) plastic tie line into the 120-cm (48-in.) line.

The X-605 and X-608 well fields contain 19 wells with a total pumping capacity of almost 114 million L/d (30 MGD). However, because of aquifer condition, periodic silting and encrustation of the wells, as well as normal maintenance outages, their combined reliable pumping capacity is between 57 and 66.5 million L/d (15 and 17.5 MGD).

The X-6609 Well Field, constructed to support the GCEP, is composed of 12 wells with a design capacity of 32.68 million L/d (8.6 MGD). The X-6609 raw water supply is carried to the X-611 Water Treatment Plant through a 75-cm (30-in.) line. Water from X-605 flows to X-611 through a tie line into the 75-cm (30-in.) line from X-6609. At X-611, the water is treated with lime to remove a major portion of its carbonate hardness and a polymer for coagulation of precipitated solids. Following this softening process, treated water flows directly into the basins of the GDP cooling towers to “make-up” for evaporation and blowdown losses from the RCW system. The system, which consists of seven cooling towers, three pumphouses, and supply and return headers paralleling the three process buildings, is used to remove excess heat from the diffusion process.

Within the GCEP area, the principal elements of the Cooling Tower Water System consist of a pumphouse, cooling tower, and distribution piping. The system was designed to remove heat from the closed-loop Machine Cooling Water Systems and from air conditioning condensers in various facilities during the time the diffusion machinery was producing waste heat.

Following the softening process at the X-611 Water Treatment Plant, a portion of the water receives additional treatment for use as sanitary water within the facility. At X-611, the water is chlorinated, the pH is adjusted, and the water is treated with a phosphate compound for corrosion control. Residual suspended solids and bacteria are removed in the X-611C Filter House, which contains four sand filters having a combined rated capacity of approximately 15.2 million L/d (4 MGD).

At the X-611C Filter House, pumps discharge filtered water into the sanitary water distribution piping system. The X-612 Elevated Water Tank has a 950,000-L (250,000-gal) capacity. X-612 is used to maintain a stable pressure for the system (approximately 85 psi).

The fire protection sprinkler systems for all GDP facilities, except the three process buildings and their respective cooling towers, are fed from the sanitary water system. There are separate piping systems within each building for sanitary purposes and fire protection. Fire hydrants throughout the site feed directly off the sanitary water distribution piping.

The primary supply of sanitary water for the GCEP area is directly from X-611 through a pipeline that parallels Perimeter Road to the X-6644 Sanitary and Firewater Pumphouse. The X-6613 Sanitary Water Storage Tank, one of three 7.6-million-L (2-million-gal) concrete tanks, is used for buffer capacity. Booster pumps within X-6644 supply sanitary water to the GCEP area facilities and to the GDP area through several connections with the GCEP piping system.

A separate high-pressure firewater distribution system for the sprinkler systems in the three GDP process buildings and their respective cooling towers was constructed in 1959. The system is fed from the RCW make-up water line leading from X-611 and into the X-640-1 Firewater Pumphouse. Pumps within X-640-1 are used to maintain an appropriate water level in the X-640-2 Elevated Storage Tank, which has a capacity of 11.14 million L (300,000 gal). The tank has a height of 91.44 m (300 ft), which maintains the system pressure at approximately 125 psi.

The high-pressure firewater system was extended to provide fire hydrant and sprinkler system feed water for the GCEP area. Sanitary water flowing from X-611 to the X-6644 sanitary and firewater pumphouse can be valved to two firewater storage tanks that provide 15.2 million L (4 million gal) of backup capacity. Booster pumps within X-6644 feed water into the firewater distribution piping system throughout the newer facilities. Cross-connections also exist with the GDP high-pressure firewater piping around X-326. The GDP/GCEP area high-pressure firewater system is considered one system with each site serving as a backup to the other.

3.9.2.4 Wastewater treatment

The PORTS X-6619 Sewage Treatment Plant (STP) is located in Quadrant III. The plant was built in 1980 and became operational in 1981. It is comprised of four reinforced concrete buildings (screen building, sludge pumping building, filter building, and chlorine building), totaling approximately 1524 m^2 (5000 ft^2); two circular clarifiers; four aeration tanks; two aerobic digesters; and five sludge drying beds.

The PORTS sanitary sewers feed by gravity into one of six lift stations around the plant site or feed directly to the X-614A Pump Station on X-6614J Sewage Lift Station. The sewage collection system is constructed of vitrified clay tile. The lines from the lift stations to the X-614A Pump Station are vitrified clay pipe, and the force main from X-614A to the X-6619 Sewage Treatment Facility is cast-iron pipe. The lift stations and the pump station operate independently.

The X-6619 Sewage Treatment Plant utilizes aerobic digesters, aeration tanks, clarifiers, filters, and an activated sludge process to provide adequate sewage treatment. Following post-chlorination, dechromanation, and effluent monitoring, treated wastewater flows directly to the Scioto River through a pipeline. Dried digested sludge is containerized in 209-L (55-gal) drums and is stored as low-level waste on-site pending subsequent disposal at an appropriate disposal facility such as Envirocare in Utah.

3.9.2.5 Holding ponds and lagoons

Holding ponds and lagoons are used to control plant process effluent and storm water runoff. The ponds and lagoons also promote chlorine dissipation and settling of sediment mobilized by storm water runoff. Many also serve as spill retention basins to prevent off-site migration of spills or accidental discharges until treatment or recovery can be accomplished. Several ponds were designed specifically to treat process effluent. For example, the X-611B Sludge Lagoon is used for deposition of lime sludge generated from the drinking water purification process. Table 3.13 summarizes all the holding ponds on-site, their respective uses, and the surface water bodies into which they drain.

Table 3.13. PORTS holding ponds

Pond	Location (Quadrant)	Purpose/use	Discharges to
X-230J5	West (III)	Control storm water runoff/sedimentation	Scioto River
X-230J6	Northeast (IV)	Control storm water runoff/sedimentation	Little Beaver Creek
X-230J7	Northeast (II)	Control storm water runoff/sedimentation	Little Beaver Creek
X-230K	Southeast (I)	Control storm water runoff/coal pile steam plant discharge	Big Run Creek
X-230L	North (IV)	Spill retention/control storm runoff/sedimentation	Little Beaver Creek
X-611A[a]	Northeast (IV)	Lime sludge lagoons (3), water treatment effluent	Little Beaver Creek
X-611B	Northeast (IV)	Lime sludge lagoon, water treatment effluent	Little Beaver Creek
X-701B	Northeast (II)	Treatment of effluent	East Drainage Ditch
X-2230M	Southwest (I)	Control storm water runoff/sedimentation from GCEP	Scioto River
X-2230N	West (III)	Control sedimentation from GCEP construction	Scioto River

Source: DOE 1999b.
[a]Converted to a prairie habitat.
GCEP = Gas Centrifuge Enrichment Plant.

3.9.2.6 Telecommunications

PORTS currently has two Fujitsu-Omni 53 telephone switches with 2300 existing line connections. The site feed lines are copper cables capable of handling analog and digital signals through the Piketon, Ohio, exchange. Long distance service is through the Federal Telephone System. Commercial phone service is available. The site distribution system contains both copper and fiber-optic units.

3.10 NOISE

Noise at PORTS is intermittent and intensity levels vary. Noise levels associated with construction and processing activities and local traffic are comparable to those of any other industrial site. No sensitive receptor sites, such as picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, or hotels, are in the immediate vicinity of PORTS.

3.11 EXISTING RADIOLOGICAL AND CHEMICAL EXPOSURES

3.11.1 Public Radiation Dose

Potential impacts on human health from PORTS operations were calculated based on environmental monitoring and surveillance data. The effect of radionuclides released to the atmosphere was characterized by calculating effective dose equivalents (EDEs) to the maximally exposed person (a hypothetical individual who is assumed to reside at the most exposed point on the plant boundary) and to the entire population (approximately 918,000 residents) within 80.47 km (50 miles) of the plant. The maximum potential EDE to an off-site individual from DOE air emission sources at PORTS in 1999 was 0.00048 millirem (mrem)/year. USEC calculated the maximum potential dose to an off-site individual in 1999 to be 0.28 mrem/year. The combined dose from USEC and DOE sources is well below the 10 mrem/year NESHAP limit applicable to PORTS and the 300 mrem/year (approximate) dose that the average individual in the United States receives from natural sources of radiation. The collective EDE to the entire population within 80.5 km (50 miles) of PORTS in 1999 was 1.0 person-rem, based on USEC calculations of 1.0 person-rem/year from USEC sources and 0.00077 person-rem/year from DOE sources. The collective EDE to the nearest community, Piketon, was calculated to be 0.15 person-rem/year, based on USEC calculations of 0.15 person-rem/year from USEC sources and 0.00014 person-rem/year from DOE sources (DOE 2000c).

Based on a person driving past the PORTS depleted uranium cylinder storage yards to and from work for a year, the maximum estimated potential exposure to a member of the public from radiation from the cylinder yards is less than 0.55 mrem/year. The average yearly dose to a person in the United States from natural and man-made radiation sources is approximately 366 mrem. The potential estimated dose from the cylinder yards to a member of the public is less than 0.2% of the average yearly radiation exposure for a person in the United States.

3.11.2 Occupational Radiation Dose

The Radiation Exposure Information Reporting System report is an electronic file created annually to comply with DOE Order 5484.1. This report contains exposure results for all monitored individuals at PORTS, including visitors, with a positive exposure during the previous calendar year. The 2000 Radiation Exposure Information Reporting System report indicated that there were no visitors with a positive exposure. The average total effective dose in 2000 for all PORTS employees and subcontractors was 3.72 mrem (DOE 2000c).

3.11.3 Public Chemical Exposures

Direct exposure to chemicals from PORTS does not represent a likely pathway of exposure for the public. For airborne releases, concentrations off-site are below levels which would present problems through dermal exposure or inhalation pathways. Water discharge outfalls are located within areas of the site that are not readily accessible to the general public. Public exposure to water from the outfalls on a daily basis is highly unlikely, and ingestion of water directly from the outfalls is even less likely.

3.11.4 Occupational Chemical Exposure

Historically, PORTS operations involved the use of a variety of chemicals and toxic metal hazardous materials to which workers (potentially) have been exposed. These included solvents (e.g., TCE, carbon tetrachloride, methylene chloride, and benzene), toxic materials (e.g., arsenic, mercury, lithium, chromium, nickel, and beryllium), toxic gases [e.g., fluorine, hydrogen fluoride (HF), welding fumes, hydrogen cyanide, chlorine, chlorine trifluoride and its byproducts, and ammonia], acids (e.g., nitric acid and hydrochloric acid), and biocides and fungicides. Many of these materials have been greatly reduced or eliminated from routine operations, but workers involved in environmental restoration and waste management activities continue to face potential exposures.

The Hazardous Chemical Inventory Report, which includes the identity, location, storage information, and hazards of the chemicals that exceeded threshold planning quantities, is submitted annually to state and local authorities. Twenty-one materials stored by DOE-PORTS exceeded the threshold planning quantities in 2000: aluminum oxide, diesel fuel, ethylene glycol, lithium hydroxide, PCBs, sodium fluoride, sulfuric acid, triuranium octaoxide, UF_6, uranium tetrafluoride, uranium (ingots and fuel rods), uranium trioxide, uranium dioxide, asbestos, argon, gasoline, lube oil, Trichloroethane (TCA), sodium chloride, methanol, and oxygen.

3.11.5 Occupational Health Services

Occupational health services for DOE and DOE's site management contractor employees have been arranged through a subcontract with the Southern Ohio Medical Center (SOMC), Portsmouth, Ohio. SOMC is a full-service community medical center, and its occupational health clinic offers comprehensive occupational health services, including chemical exposure screening. The SOMC occupational medical staff has some familiarity with PORTS operations from past contracts with the USEC Medical Department.

DOE's site management contractor and subcontractors are responsible for procuring their own medical services from SOMC. Some subcontractors have opted to retain the on-site medical services of the USEC Medical Department. DOE's site management contractor has mandated that the PORTS subcontractors adhere to the medical requirements in DOE Order 440.1A, Chapter 19, "Occupational Medicine," as listed in Exhibit G of their subcontracts.

3.12 ACCIDENTS

Potential accidents at PORTS are primarily associated with the approximately 13,900 DOE-managed cylinders containing depleted UF_6. The cylinders are stored in the X-745-C (C-yard) and X-745-E (E-yard) located in the northern part of PORTS just inside Perimeter Road.

The chemical and physical characteristics of depleted UF_6 pose potential health risks, and the material is handled accordingly. Uranium and its decay products in depleted UF_6 in storage emit low levels of alpha, beta, gamma, and neutron radiation. The radiation levels measured on the outside surface of filled depleted UF_6 cylinders are typically about 2 to 3 mrem/h, decreasing to about 1 mrem/h at a distance of 0.3 m (1 ft). If depleted UF_6 is released to the atmosphere, it reacts with water vapor in the air to form hydrogen fluoride (HF) and a uranium oxyfluoride compound called uranyl fluoride. These products are chemically toxic. Uranium is a heavy metal that, in addition to being radioactive, can have toxic chemical effects (primarily on the kidneys) if it enters the bloodstream by means of ingestion or inhalation. HF is an extremely corrosive gas that can damage the lungs and cause death if inhaled at high enough concentrations.

Cylinders are stored with minimum risks to workers, members of the general public, and the environment at PORTS. DOE maintains an active cylinder management program to improve storage conditions in the cylinder yards, to monitor cylinder integrity by conducting routine inspections for breaches, and to perform cylinder maintenance and repairs to cylinders and the storage yards, as needed.

Potential accidents related to the PORTS cylinder yards have been analyzed in the SAR for PORTS (LMES 1997). The SAR identified major hazards associated with confinement failures that could result in the release of UF_6—a release of solid or gaseous UF_6 to the atmosphere from cylinder failure and a cylinder yard fire. In the first case, a large spill of solid material was considered to bound all of the smaller releases that could occur. The conclusions of the SAR were that cylinder failure does not pose a severe health risk beyond approximately 200 m (656 ft). Because of the slow release rate, workers in the immediate area of the release could easily evacuate the area without being significantly exposed. On-site personnel are trained to flee areas where releases are detected by sight and/or odor (i.e., odor of HF at extremely low concentration levels is easily detectable). Beyond the 200 m (656 ft) and for the off-site public, both uranium intake and the HF exposure were estimated to be below the guideline threshold values of 10 mg uranium intake and 2.3 mg/m^3 HF exposure with no mitigation.

In the case of the cylinder yard fire, the event was not expected to occur during the life of the facility but was postulated as a worst-case scenario. The conclusions for the cylinder yard fire showed that the threshold values designed to protect public health of 30 mg uranium intake and 23.2 mg/m^3 HF exposure could be exceeded on-site to about 275 m (900 ft) for the initial release if no mitigative actions were taken. Off-site boundaries are greater than 300 m (984 ft) from the cylinder yards. This scenario is estimated to have an extremely unlikely frequency. Primary controls to minimize the likelihood of a cylinder yard fire include preventative measures (e.g., inspection of cylinders before welding and the Fire Protection Program and its established controls). Although a cylinder yard fire case exceeds the guidelines for distances on-site, the combination of stringent controls to prevent a fire and a well-prepared emergency response plan limit the associated risk.

The disposition of the cylinders at PORTS has been addressed by DOE in the Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride (DOE/EIS-0269). The decision to construct and operate a cylinder conversion facility at PORTS will affect the probabilities and impacts of potential accidents.